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Dye Plants and Dyeing

by Brooklyn Botanic Gardens

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PLANTS & GARDENS
BROOKLYN BOTANIC GARDEN RECORD

DYE PLANTS AND DYEING

A HANDBOOK

COLORING YARNS AND TEXTILES
WITH DYES FROM PLANTS–
BASIC DIRECTIONS

Recipes From Many Countries
Culture of Dye Plants
Historical Background

This Handbook is a
Special Printing of
PLANTS & GARDENS
Vol. 20 No. 3 [illegible]

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(Continued inside back cover)

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Frank J. Farley

Dye plants and other useful herbs drying in a craftsman's attic

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HANDBOOK ON DYE PLANTS & DYEING

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LETTER FROM THE BROOKLYN BOTANIC GARDEN

This Handbook on natural plant dyes and how to use them has many objectives, not the least of which is to help in the revival of an ancient craft. For thousands of years, and up until about a century ago, the color of fabrics, whether clothes, rugs or tapestries, came chiefly from the crude juices of plants. Whoever made the first discovery—or was it an "invention"?—we shall never know. What we do know is that the use of the indigo plant (for dyeing fabrics blue) dates beyond 3000 B.C. History also tells us that it was probably a thousand years later (2000 B.C.) before man knew how to combine other substances in the dyeing process to make the colors "fast." This later discovery, now known as mordanting, helped for at least 4,000 years to give the world colored fabrics that were surprisingly resistant to fading if exposed to water or sunlight. But more important, when they did fade, whether from sheer age or from exposure to light, the colors largely kept their charm and proper interrelationships.

With the discovery of aniline dyes about a century ago, and the development of scientific methods generally, exact colors became reproducible. Thus the skill and craftsmanship of the individual were lost to mass production. Except for occasional individual craftsmen, the ancient art is no longer generally known or practiced in advanced nations. Yet it is an art that belongs in an important way to the plantsman—the gardener and the horticulturist, who wants a personal experience in transferring the pigments of the landscape to the fabrics of home and wardrobe.

Modern dyes are produced in great factories but what greater factory is there than Nature herself? Plants are indeed living factories that produce food and fiber, lumber, antibiotics, and scores of substances as yet little understood by the chemist. Natural dyes come from many parts of plants—roots, leaves, bark, flowers and fruits. Chemical-Engineer George Cranch, whose avocations include dyeing and weaving, has written as follows in HANDWEAVER & CRAFTSMAN: "Now you have started. You look up old formulas. You see old tapestries with new eyes. You try other flowers, barberry bush trimmings, privet, pokeweed, autumn leaves, blueberries. Some work, some don't. The landscape changes in meaning. This field of goldenrod is now a mine of dye. That sneezy ragweed seems to have a lime-green color (it does on wool). . . . You sense nature in a new way; new hues, new smells, a new intimacy."

Guest Editor Schetky, her invited authors and members of our Editorial Committee have pooled their ideas, knowledge and resources to bring this hundred-page book into being, Warm responses to inquiries in other countries have given us a feeling of great friendship for people in many parts of the world (see p. 38). Their dyeing formulas, including how-to-do-it recipes from 18 different countries, are given here for all who have the urge to try them. Thousands of hand-knitted natural-plant-dyed sweaters with new colors should spring from this Handbook, not to mention fabrics. Of special significance is the relevance of dye plants to ethnological studies.

There are sources of supply for those who want to purchase the natural dyestuffs (p. 32), but let it be said here for those who want to collect or grow their own, that dye plants are not fussy—they are at home in almost any soil and many climates.

Yours sincerely,

George S. Avery

Director Emeritus

The New York Unit of the Herb Society of America has, by gift, made possible all color and other illustrations in this Handbook.

THE AGELESS ART OF DYEING

EthelJane McD. Schetky

MANY of us have as a treasured heirloom a hand-woven coverlet, the yarns home-dyed, or an old hand-hooked rug, its colors mellow with age but beautiful. Others admire such treasures in museums.

Always the same question is asked: "What did our ancestors use for dyes, and how did they know how to achieve these beautiful tones?"

The answer takes us back many centuries, for some of the dye plants used by our immediate ancestors were known to the ancient Greeks and Romans. We of today can color yarns and textiles with dye prepared from these same plants and animals, and we can set the colors just as our forebears did—and as the Mediterranean peoples did two thousand years and more ago. Dyeing with natural products is an ageless art. It is, in fact, a prehistoric craft, though the prehistoric dyes were merely fugitive stains from fruits, flowers and barks.

Animal Dyes of the Ancients

The first dye of interest is purple. Evidence of its antiquity is supplied in the fragments of purple-trimmed robes found in excavations of Grecian tombs. The ancient Phoenician town of Tyre is the accepted home of purple dyeing from Mediterranean shellfish of the genera *Purpura* and *Murex*. These are whelks, both kinds with long spiral shells greatly enlarged at the open end. The dye was extracted from the mucous gland adjacent to the respiratory cavity. It possessed fastness and brilliance of color, but was very costly. The Phoenicians, who were master shipbuilders and the most skillful sailors of antiquity, searched for these shellfish on every coast available to them. Wherever they found them in abundance, they established trading stations and dye works. Because of the great demand for the purple color, honey and orseille (*Roccella*), a lichen growing on rocks near the sea, were often used to dilute it. A Greek work of the third century A.D., now in a library in Stockholm, contains many recipes for imitating genuine purple.

We know of such things in large part from the first-century writings of two men whose works remained the principal sources of scientific knowledge for several centuries. One was Dioscorides, the Greek physician, whose work is still known in Latin translation as "De Materia Medica"; the other was Pliny the Elder, the Roman naturalist, author of "Historia Naturalis." Later, the rare and beautiful manuscripts of medieval monks recorded the culture and use of dye plants.

Pliny describes the complicated preparation of the various shellfish, which gave shades of red, blue and violet as well as rich purple. The wool to be dyed, he states, was treated first with soapwort (*Saponaria officinalis*), oxgall or alum.

Another ancient animal dye is kermes, which comes from the dried bodies of the females of a species of shield louse or scale insect (*Kermes ilicis*), which lives on two Mediterranean trees, the kermes oak (*Quercus coccifera*) and the holm oak (*Quercus ilex*). Its use was first recorded in 1727 B.C.; its color, a beautiful red. Wool, silk and leather could be dyed with kermes. Alum and urine were used in preparing the dye bath. In Islam the scarlet fez and in Greece a cap of the same color were both dyed entirely with kermes. Only those in possession of the prescribed color could manufacture these standard articles of dress.

In Greece and her colonies, near the beginning of the Christian era, the dyer's craft was widespread. While natural-colored wool was used for everyday wear, the prosperity of the period, the people's love of beauty, and the influence of oriental luxury all augmented the demand for color. Workshops increased rapidly. Dyers strove to achieve colors fast to light and water.

Robertson

The kermes oak (*Quercus coccifera*) is one of the host plants for a scale insect (*Kermes ilicis*) which was a source of red dye for more than 3,000 years.

Early Records of Dye Plants

Dioscorides describes the dye plants of the ancient world: madder (*Rubia tinctorum*) for red, through the years the most enduring red dye from a plant: saffron (*Crocus sativus*) and weld (*Reseda luteola*) for yellow; woad (*Isatis tinctoria*) for blue. The bark of oak, outer shells of fresh walnuts, branches of broom, pomegranate flowers, dyer's bugloss (*Alkanna or Anchusa tinctoria*) were among others used. Gallnuts, woody swellings caused by attacks of gallflies, presumably on the Lusitanian oak (*Quercus lusitanica*) often provided both a dye and a mordant. They are known to be high in tannic acid.

From descriptions of both Dioscorides and Pliny, it is quite evident that indigo from the Orient was already known in the Mediterranean region. In fact, in 450 B.C. Herodotus described the way in which indigo was being used.

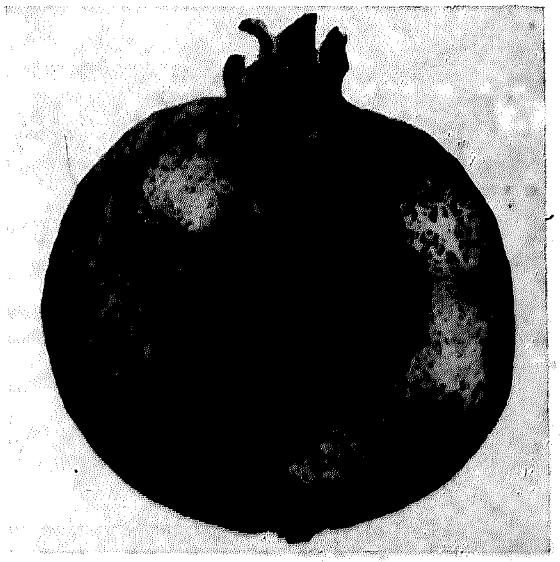
Simple names of colors are seldom found in classical languages. Dyers harmonized colors with some analogy of nature. Ovid, advising women on colors for their clothing in his "Art of Love," speaks of the pure blue of the cloudless sky, the yellow of saffron, the green of Paphian myrtle (from Paphos, ancient city of Cyprus), the darker green of the oak, the almond tree, the gray of the crane, the amethyst.

Dyes and techniques of the Romans and Greeks were undoubtedly the same. Excavations at Pompeii show how complete the dyers' shops were. The perfection attained by these early people with their primitive equipment is scarcely outdone by present-day methods.

Alum, which generally occurs as an earthy deposit, was part of the dyeing process in the ancient world as it is today. Later, common salt and cream of tartar were also used as mordants. Two sources of alum, one of them still in use in the 20th century, are known to have existed in Turkey 500 years ago. From ports in Asia Minor this alum was taken to Europe for the dye-trade. Sources were also developed in Spain in the 16th century and large amounts were exported via Antwerp to Holland, France and Germany.

Dyes for Leather Goods

Skins and dressed hides of sheep, goats, hyenas, bison and deer led to the devel-



The thick red skin of the pomegranate (*Punica granatum*) is both ancient and modern as a source of tannin and dye, especially for leather. Yellow, brown, and violet blue are obtainable on cloth with different mordants.

opment of another craft, the dyeing of leather. The ancients were masters in dyeing leather, using the bark of the date plum (*Diospyros lotos*, a botanical relative of the American persimmon tree) when they could obtain it; also the bark of barberry, pine and alder and roots of barberry; as well as madder, kermes, ivy and bluestone or vitriol.

In Egypt, vegetable dyes were used exclusively for leather. Among them were safflower, woad and roots of barberry. The Moors introduced into Spain the method of tanning leather with the rind of pomegranate (*Punica granatum*) and brought the fruits to Cordova for the fine leather produced there.

Early Trade Between Europe and Asia

Excavations have produced artifacts to prove that commerce between China and the Mediterranean world existed long before the era of recorded history. Caravans or camel-trains crossed the Gobi Desert for centuries. In "The Syrian Desert, Caravans, Travel and Exploration," (Macmillan, New York, 1938), Christina Phelps Grant tells how camels, often 50 in a string, would be fastened together, the leader gaily decorated with colored yarns and beads. Often several strings, amounting to several thousand, traveled in a group. Homing pigeons relayed their progress from stations every 50 miles. Great quantities of goods were thus transported to the markets of the Mediterranean.

One route led to Baghdad, a city of wealth and grandeur, then to Damascus, to Jerusalem and to Cairo. A second route went from Damascus to Mosul (which gave its name to muslin, just as damask is derived from Damascus), then to the Black Sea in order to reach Byzantium (now Istanbul). This already well-established city became a great reservoir for trade goods from the East, including dyestuffs, raw materials, jewels, spices, incense and costly articles for the churches.

Such trade continued. By the eighth century, merchants from every oriental city had quarters in Damascus. Constantinople (the former Byzantium) was even better able to link the business interests of the East and West. By 1162, the records show that 1200 merchants from Italy alone were located in that city.

Venice, being in a strategic location for both overland and sea trade, became the principal city for importing dyestuffs from the East. Trade routes over the Alps reached the large commercial cities of southern Germany, and a fleet of ships sailing around Spain and France carried goods to Flanders, Southampton and London. Thriving dye-trades were also carried on in the Mediterranean cities of Florence, Pisa and Genoa. For many years Genoa had a monopoly on the alum trade.

European dyers, already flourishing in the 10th century, reached their height in the 13th century. Their fine craftsmanship was due largely to the guilds, which were vigilant in maintaining a high standard of quality.

Marco Polo, the Venetian traveler of the 13th and early 14th centuries, brought back from China information on sapan (*Caesalpinia sappan*) as a red dyewood. This had been the first species of brazilwood to be known in Europe, and it was already in use there. (Other species were later discovered to have been long in use in South America.) He also reported on the preparation of indigo, a dye already known in Europe, though not yet used extensively, partly because of its high price.

Dye-goods at Medieval Fairs

As towns grew, European trade increased via the passes through the Alps, and exchange of goods developed through large fairs. Merchants and travelers from the North were attracted to the Italian towns. The six famous fairs of Champagne in northeastern France were organized into a continuous clearing house for all of Europe. Dyes were among the important products traded. While oriental dyes were not unknown, the principal coloring matters were from native plants, especially woad, which supplied shades of blue. Colors available from other

Courtesy of the Borough of Saffron Walden

The crest of Saffron Walden in **Essex, England**, where the saffron crocus (*C. sativus*) was extensively grown for the medieval dye trade. The original shows this crocus in the full color of its purple flowers with the "golden" (orange) stigmas that provide the **yellow coloring.**

plants were russet and other reddish tones, also orange and green. White, brown and gray could be had from the natural wool.

Documents of 1361 tell of dyers going to the fair at Geneva to buy saffron, woad, vitriol, gallnuts, tartar and alum. By the 15th century, Geneva had become an international center with French fabrics and luxury goods available.

Commerce in dyestuffs expanded at the Basle fair, which also became a center of trade. Tariff lists in 1400 include saffron, madder, indigo from Baghdad, kermes, brazilwood and orseille. Alum was bought in great quantities. Basle became a medieval commercial and manufacturing town. Water power was used for pounding some of the dye materials, notably saffron, gallnuts and brazilwood. The Merchants Guild called its guild room "The Saffron" and used the saffron crocus (*C. sativus*) in its coat of arms. It is also found in the coat of arms of Florence and of the town of Saffron Walden in Essex, England. For a short time the saffron crocus was grown in Basle, because of its commercial value.

The Frankfort fairs, situated in the heart of Europe, became a central market for the then-known world. In the mid-13th century much of the trade was in luxury goods, spices from the East, costly silks, wool and linen, and also dyestuffs, which were in great demand when wool weaving became a major industry.

As London and Antwerp grew into trade centers, the Frankfort merchants sent their own agents into those cities to supply them with spices, fats, oils, and with tanning agents and dyes, including woad, madder, dyewoods, gallnuts, alum, vitriol, sulphur and tartar.

Vasco da Gama's discovery of a sea route to Asia by way of the Cape of Good Hope in 1498 opened up the wealth of the Orient to European traders and reduced the traffic through the overland passes. Indigo and dyewoods accompanied the jewels and spices from Asia on ships, in this newest step in intercontinental commerce.

Historic Books on Dyeing

In 1429 the Venetian dyers' guild had drawn up a book on dyeing for its members' use. It contained a number of dye recipes.

But more important, in 1540, the Venetian Giovanni Ventur Rosetti* published the "Plictho de Larti de Tentori," a book containing 217 recipes for dyeing, covering all instructions for dyeing cloth, linen, cotton and silk. This book, though written in the baffling Venetian dialect of the day, remained the best source of dyeing information for 200 years.

The Craft in Different Countries

Turkey-red dyeing, long kept a secret in the Orient, reached Europe in 1747. It has not been ascertained how it was originally done. Only vegetable products were used, and the many processes required a month to achieve the color.

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*The author's name appears in various forms.

Each medieval country or region developed dyeing in its own individal way. In Scotland in the 12th century the dyers' trade was regulated by law under David I (1124-1153). In England dyeing grew in importance in the 14th century, when English textile manufacture began to develop on a large scale.

By the 13th century an efficient and extensive textile industry had been developed in France. Dyes used there until the 18th century were saffron, woad, madder, kermes, walnut root, alder bark, oak bark, yellow-wood, gallnuts and vitriol. The French also increased the dyers' craft by developing varied dyeing techniques to achieve additional colors from the basic dyestuffs. At the end of the 16th century 220 master dyers were listed in Paris.

The great advance in dyeing methods began in France in the 18th century, when a dye chemistry based on scientific principles was developed. The increasing production of industry inspired the study of physics and chemistry to improve methods. Science replaced old methods and a scientific system developed for dyeing. Books written by scholars of that period who contributed to the advancement of dyeing are still available.

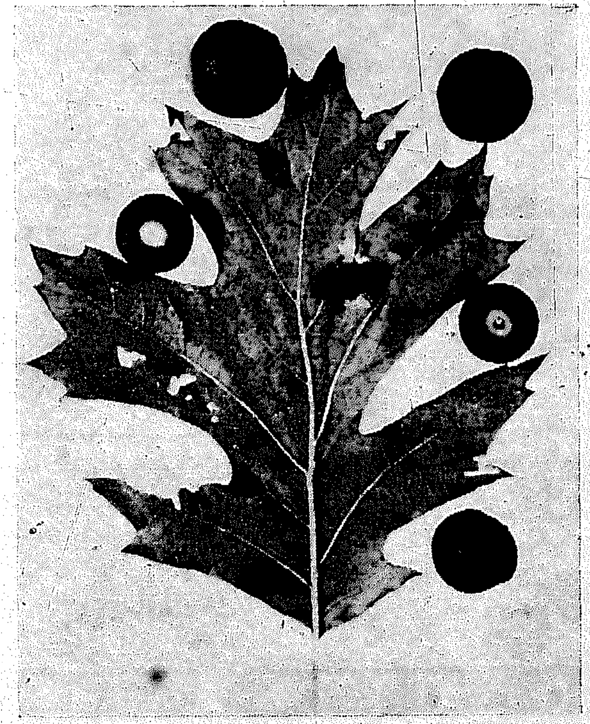
Natural dyes were universally used until the late 1800's, when aniline dyes began to appear. Commercially, these are the universal dyes of our generation. But for those interested in handcrafts and return to the dye-kettle, the beautiful soft enduring colors obtainable from natural plants will be their reward. ✦

TANNINS AND DYES FROM PLANT GALLS

GALLNUTS have been important agents for tanning, mordanting and dyeing for many centuries. As a dye source, they produce browns, grays and blacks. Until about 1940 they were used in making ink. As a mordant, they supply tannin, and it is their tannin content that also makes them valuable for the processing of leather.

Gallnuts are abnormal growths chiefly on the leaves and branches of certain kinds of trees. Those of principal interest are caused by insects. Many result from a gall wasp, the sting of which stimulates the plant cells into excessive growth. The resulting structure—oak-apple, gallnut, or whatever it may be—becomes the home of the attacker. The feeding activities of the larvae that develop within the gall release chemical stimuli which increase the tannin above that of the normal cells of the plant.

Oaks are more subject to galls than any other plant. The gallnut chiefly used in the Mediterranean region is a nutlike growth that develops on the Mediterranean oak (*Quercus lusitanica*). In Japan, when recipes for dyeing mention gallnuts, they generally refer to a hard swelling on the leaf of sumac (*Rhus javanica*).



Buhle

Oak leaf and small oak galls such as drop from trees in autumn. Sectioned galls above show insect larva at center.

Basic steps in

MORDANTING AND DYEING

FOR many centuries almost all dyes came from plants, colors from certain shellfish and insects being the principal exceptions. The beauty and warmth of the hues derived from natural dye plant materials are avaliable today to all who venture into the dye pot.

Dyeing cannot be done hurriedly. Generally two processes are involved: mordanting and dyeing. Fastness of color depends on mordanting, so this process is quite as important as the dyeing itself.

The word "mordant," derived from the Latin *mordere,* meaning to bite, refers to any substance applied for the purpose of fixing the color. It must be capable of combining chemically with the coloring matter being applied. While a few plant dyes may be used directly, the majority require a mordant for permanent color. In fact, some dyers find it expedient always to use a mordant. Thus mordanting is generally essential if the dye is to take properly and remain permanent. It also enriches the color.

Substances most frequently used in mordants are the metallic salts of alum, chrome, iron and tin. Among other agents used are acetic acid, ammonia, blue vitriol, caustic soda, lime, tannic acid and tartaric acid. Some of these will be found on household shelves in one form or another; a few can be obtained at grocery and drug stores, as shown below. Others must be sought at chemical or dye supply houses, where one-pound containers are generally the smallest available; drug stores will generally order such items for regular customers.

Characteristics of the Mordants

The Metallic Salts

Alum: Potassium aluminum sulfate, a white powder commonly known as potassium (or potash) alum. The kind of alum found in small packages at grocery stores is ammonium alum; this is less successful as a mordanting agent. An excess of alum leaves wool sticky.

Chrome: Potassium (or sodium) dichromate (also called bichromate of potash or soda). Powdery orange crystals which are sensitive to light. Available in one-pound containers. A skin irritant to some users.

Iron: Ferrous sulfate, a very pale green crystalline powder, known also as green vitriol and, especially by dyers, as copperas. It tends to harden as well as darken wool while making the color fast.

Tin: Stannous chloride crystals in the form of a white powder, available in quarter-pound containers. If too much is used, it is likely to leave wool both harsh and brittle.

Other Mordanting Agents

Acetic acid: The acid principle of vinegar, used to acidify a dye bath solution, to neutralize alkaline water, and as a solvent for coloring matter. Vinegar itself may be used.

Ammonia: Ammonium hydroxide, which is clear household ammonia (*but not the sudsy kind*).

Blue vitriol: Copper sulfate, which comes as large blue crystals. Available at drug stores.

Caustic soda: Sodium hydroxide, irregular white pellets, which can be purchased at drug and grocery stores. Destructive if dropped on clothing. Another type of caustic soda, the anhydrous form of sodium sulfite, is also used, but it must be ordered in advance by the pound.

Lime: Calcium oxide or slaked lime, a powdery white substance. A common hardware or builder's supply item, but in most drug stores in one-pound containers.

Tannic acid: A tannin, which is the astringent principle in all parts of sumac, in oak bark and in gallnuts (hard swellings on certain oaks, caused by gallflies); present also in other plants. Available at drug stores as a pale-brown powder in quarter-pound packages.

Tartaric acid: Acid potassium tartrate, a white powder, obtainable at drug stores or, as cream of tartar at grocery stores. An ancient source was the deposit from grapes in wine casks.

Equipment Needed

1. A good supply of soft water (rain water, wherever possible).
2. Dye pot or kettle of copper, stainless steel or enamelware.
3. Scales for weighing fabrics or yarns to be dyed, also plant parts used in preparing the dye. For very small quantities, letter scales are adequate.
4. Cooking thermometer.
5. Two Pyrex pitchers, pint and quart, for liquid measures.
6. Apothecary's measure for small amounts of liquid.
7. Plastic spoons for the mordanting chemicals.
8. Glass rods for stirring. (If stirrers are of wood, use a separate one for each color.)
9. Buckets for rinsing (plastic ones are easiest to handle).

General Rules for Mordanting and Dyeing Wool

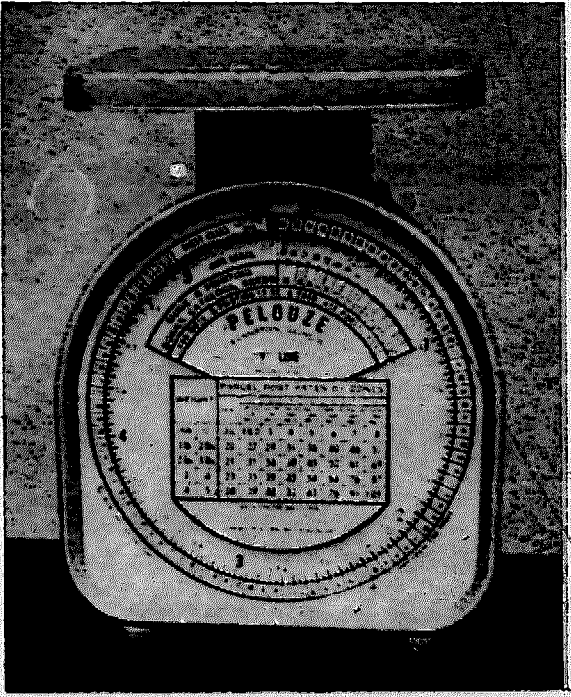
Woolen material or yarn must be thoroughly washed to free it from grease. Skeins of yarn should be tied loosely but securely with cotton cord in several places. Use mild white soap flakes (*not* a detergent) about 2 tablespoons to each gallon of warm water. If new wool is very greasy repeated washing will be necessary. Several rinsings also are essential.

If the wool is dried after washing, wet it thoroughly before mordanting by immersing in clear water; then squeeze it to remove excess water. Never twist wool when removing liquid from it; wrinkles will be all but impossible to remove.

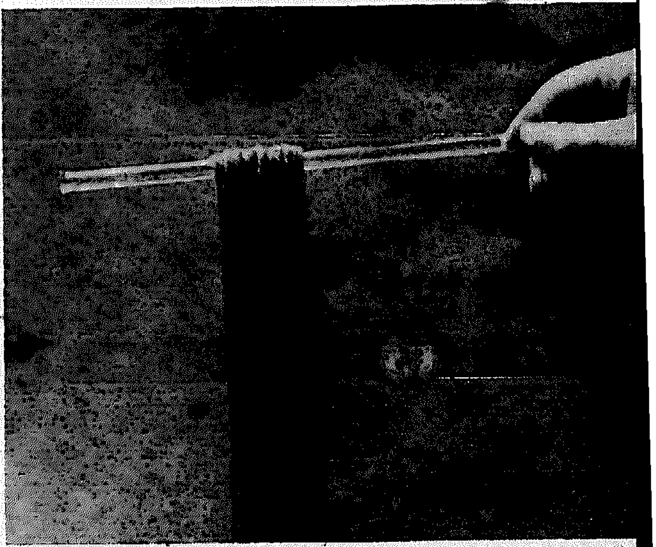
When either mordanting or dyeing, as the water evaporates, remove the wool and add the necessary quantity of water to keep the original proportions. Return the wool to the bath to finish the process.

Directions are slightly different for each kind of mordant, but with all it is important not to let the wool boil, but simmer, not to change the temperature suddenly, and to keep the yarn or cloth completely submerged during the whole process. When a mordant, thoroughly dissolved, is to be added to a dye bath, the wool should be lifted out.

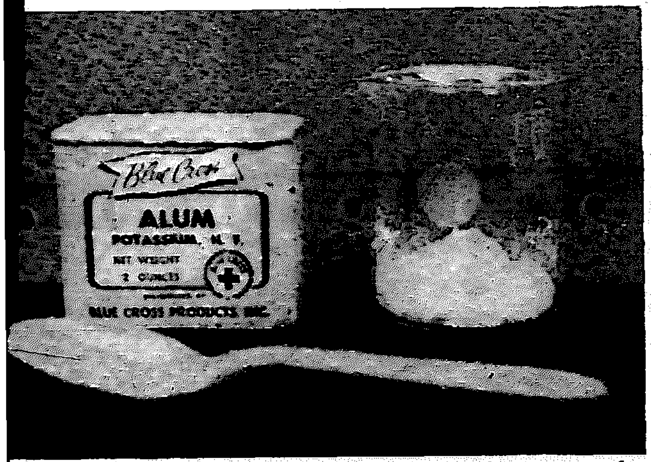
Once mordanting is finished, when done



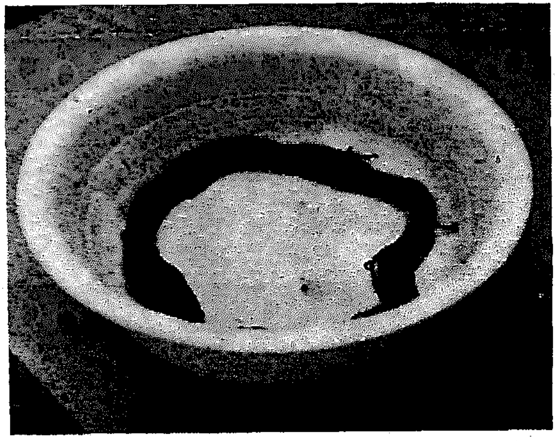
A postal scale will serve to weigh materials to be dyed as well as the plant parts and mordants to be used.



Glass rods, like the one shown here, are recommended for stirring yarn in the dye bath. If wooden stirrers are used, a different one is needed for each color.



A non-metallic spoon, plastic for example, is best for dipping into the mordanting chemicals, such as the potassium alum shown here.



Scholtz photos

Plastic or enamel utensils are easily cleaned and are therefore most desirable for rinsing. A basin will serve for small quantities; pails are required for larger lots.

as a separate process, the bath should be cooled until the wool can be handled. Then the excess water is squeezed or pressed out by hand. While still damp the mordanted yarn can be placed loosely in a towel or bag for slow drying in a cool place. This may take four or five days. It is then ready for the dye pot.

By using different mordants, different colors may be obtained with the same plant dyes. (See, for example, the child's dyeing project on the fourth color page, also the article describing some experiments in South Africa, on page 54.)

Directions are always for one pound of dry wool.

Specific Rules for Mordanting Wool

With Alum: Prepare a water bath of 4 to 4½ gallons of soft water. Heat to hand warmth. Dissolve completely 3 ounces alum and 1 ounce cream of tartar in a small quantity of water and add to the water bath. Immerse wetted wool in the water bath, spreading and stirring it. Raise the temperature gradually (allow about one hour), but not above 212 degrees Fahrenheit, which is the boiling point. Then simmer for an hour, turning the wool from time to time with a glass rod. For very fine wool, less alum and cream of tartar should be used. Too much alum imparts a sticky feeling to wool. Otherwise rinsing is not essential.

With Chrome: Although an excellent mordant for wool, chrome is so sensitive to light that uneven dyeing may result. To prevent this, keep the wool completely submerged (a plate will hold it down) and dye immediately after mordanting. Prepare a water bath of 4 to 4½ gallons and heat to hand warmth. Add ½ ounce of chrome dissolved in half a cup or so of boiling water. Enter thoroughly wetted wool, cover vessel, bring slowly to a boil during first hour, then simmer at 200 to 212 degrees for an hour, turning it only once or twice. When cool enough to handle, rinse wool in water of similar temperature. Squeeze it gently to remove excess water, then keep it covered until the dye bath is ready.

With Iron: The most generally used method is first to simmer wool gently with the coloring matter, then remove the wool and add to the bath ½ ounce of ferrous sulfate and 1 ounce of cream of tartar. Return wool to the bath and simmer for half an hour (this is called *saddening*). By some workers, using the iron after the dye has been applied is not considered true mordanting. To keep the wool soft and the color right after using iron, rinse it very thoroughly.

With Tin: Tin (stannous chloride) is used principally with cochineal for scarlet, and for some hues of yellow and orange. Directions for its use vary widely and generally require the addition of other substances (nitric acid, cream of tartar, oxalic acid, for example), all in different amounts according to the tone desired. Follow directions with precision, noting that acids should always be added to the water, never the opposite.

Sometimes a small amount of tin, dissolved in water, is added to the dye bath toward the end of dyeing to add brilliance to the color of wool which has been mordanted with alum. When so applied, the process is called *blooming*.

Whenever tin is used, the rinsing water should be soapy.

How to Mordant Cotton and Linen

The mordanting of plant fibers such as cotton and linen requires parts of four consecutive days, the material standing overnight in the bath of the previous day. This is known as the alum-tannic acid-alum method. For each pound of dry material use:

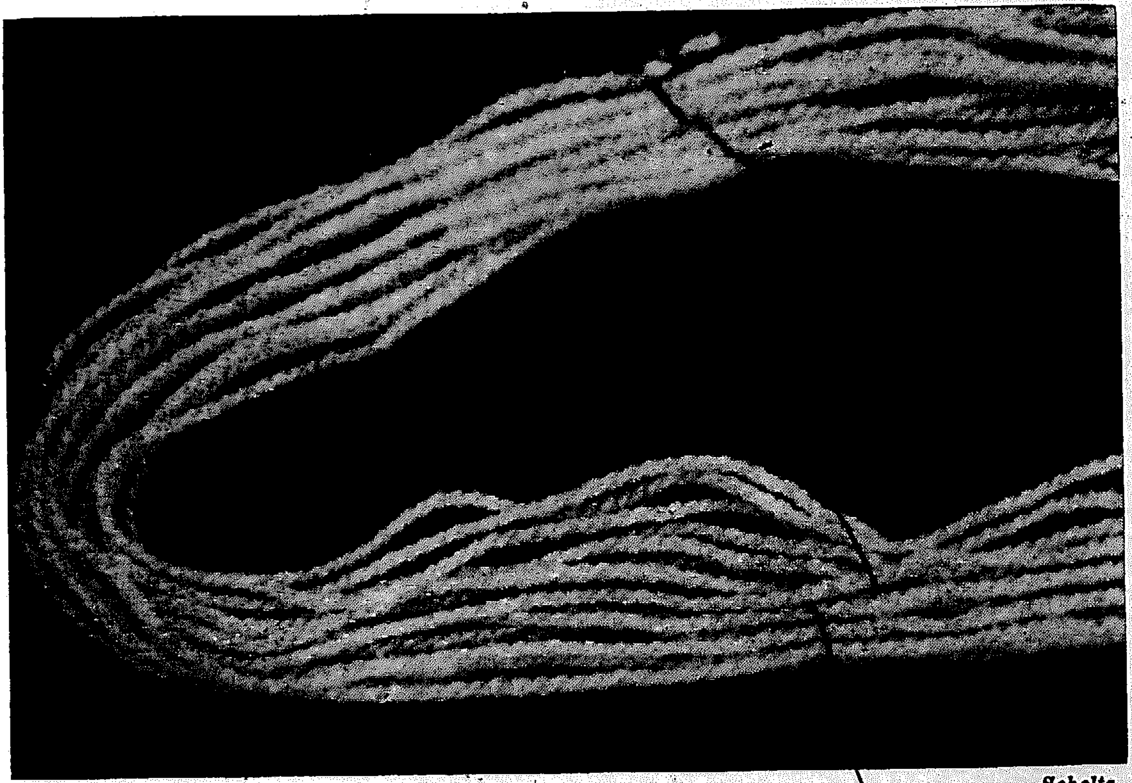
8 ounces alum (potassium alum)
2 ounces washing soda (sodium carbonate)
1 ounce tannic acid

Dissolve half the alum and half the soda in 4 to 4½ gallons of cold soft water. Wet the material in clear water, immerse it in the bath and heat gradually. Boil one hour. Then let it slowly cool and remain overnight in the bath.

Next day, squeeze the moisture from the cloth, rinse it well, then put it in a prepared bath of 4 to 4½ gallons of water with the ounce of tannic acid. Heat this bath gradually to 140 to 160 degrees and hold it at this temperature for one hour, meanwhile working the material through the bath. Cool, and let it stand overnight. Rinse lightly. Prepare a third bath of 4 to 4½ gallons of water with the remaining 4 ounces of alum and 1 ounce of soda. Repeat the first process, boiling one hour and leaving overnight. Next day, squeeze the material partly dry; rinse it before dyeing.

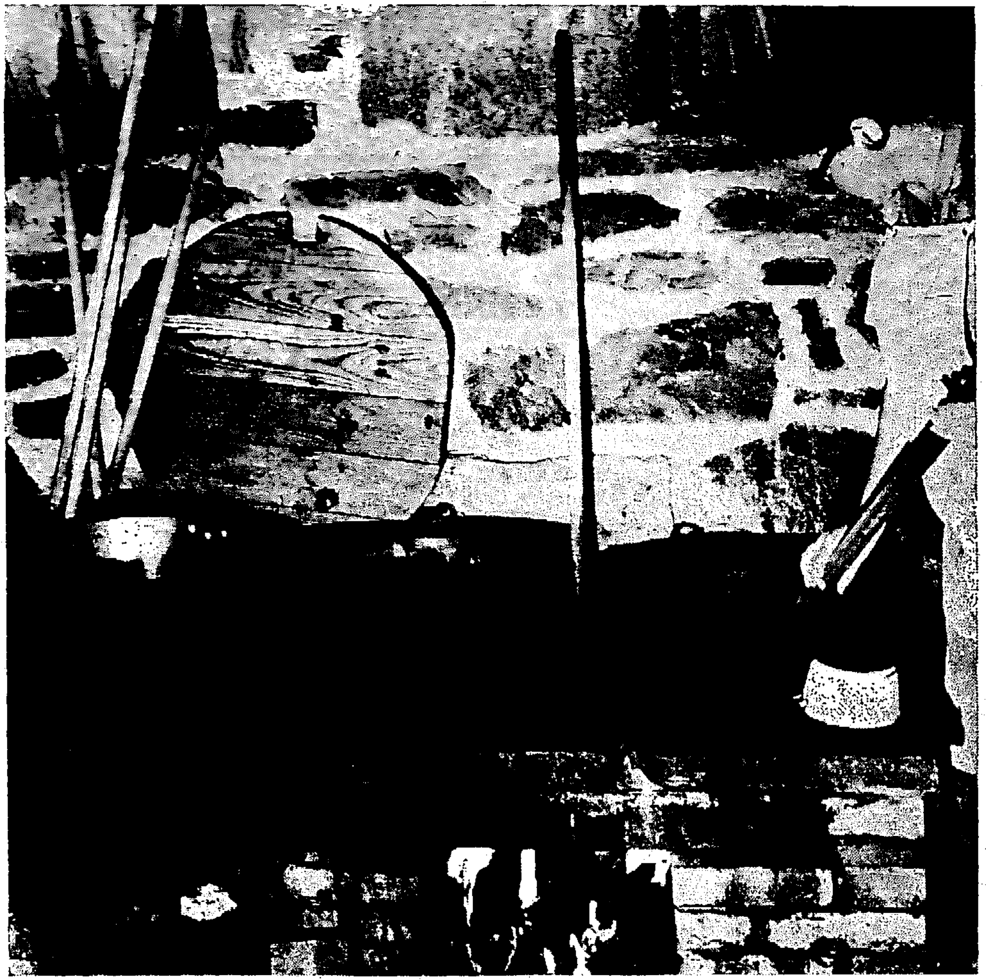
How to Handle Silk

On silk there is a waxy finish that needs to be removed by washing in warm, mild suds, then rinsing well before mordanting is begun. If raw silk is used it must be



Scholtz

A skein of yarn, before being placed in a kettle for washing, mordanting or dyeing, should be loosely tied in several places, preferably with cotton string, in the manner shown above.



Harvey Chase, courtesy of Penland School of Handicrafts

Dyeing as it is done at Penland. This school in the North Carolina mountains is one of the few that teaches the use of natural materials in dyeing processes. Large metal kettles set on slate are used over wood fires; wooden poles are used for stirring.

boiled with soap to remove the natural gum.

Silk in skeins must be handled carefully to prevent its matting; dip the skeins in and out of the dye instead of stirring them.

In both the mordanting and dyeing of silk the bath should not exceed a temperature of 160 degrees Fahrenheit. Otherwise procedures are the same as for wool.

General Directions for Dyeing

Preliminaries

For each pound of dry wool, use approximately 1 peck of plant material, or 1 pound of nut hulls, wood or bark. (Variances are noted in the recipes, pages 17-37.)

Provide a kettle large enough to hold at least 4 gallons of dye bath and the pound of wool, without crowding. Also have one or more tubs or pails at hand for rinsing.

Use rain water if possible. If hard water is the only kind available, it may be softened by the addition of acetic acid or vinegar. Testing with litmus paper (available, with directions, at the drug store) will indicate when the water is neutral, or soft.

To Prepare the Dye Bath

Crush, break or, with a stainless steel knife, chop the plant material, whether dried or fresh. Cover with water and let stand overnight. Boil one-half to two hours, the length of time depending on the color extracted. Strain into the dye kettle and add enough water to make 4 to 4½ gallons. Heat the bath to lukewarm and add the wetted wool.

To Prepare the Wool

The wool must be clean and moist when ready to enter the dye bath. There are three possible directions to follow:

(1) If no mordant is being used (or if it is to be applied after dyeing), wash the wool in mild soapsuds in lukewarm water and rinse it several times in water of the same temperature.

(2) If the wool has been mordanted and dried, wet it thoroughly in water of the same temperature as the dye bath, squeeze it gently.

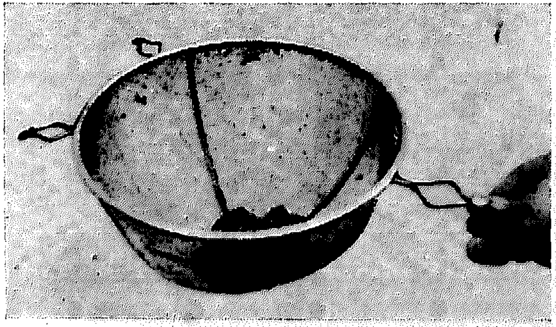
(3) If the wool has just been mordanted with chrome, dye immediately.

The Dyeing Procedure

Place the moist wool in the lukewarm dye bath (hand warmth, or about 95 degrees). Keep it in motion, moving it back and forth (not round and round) and lifting it in and out to get the dye distributed evenly.

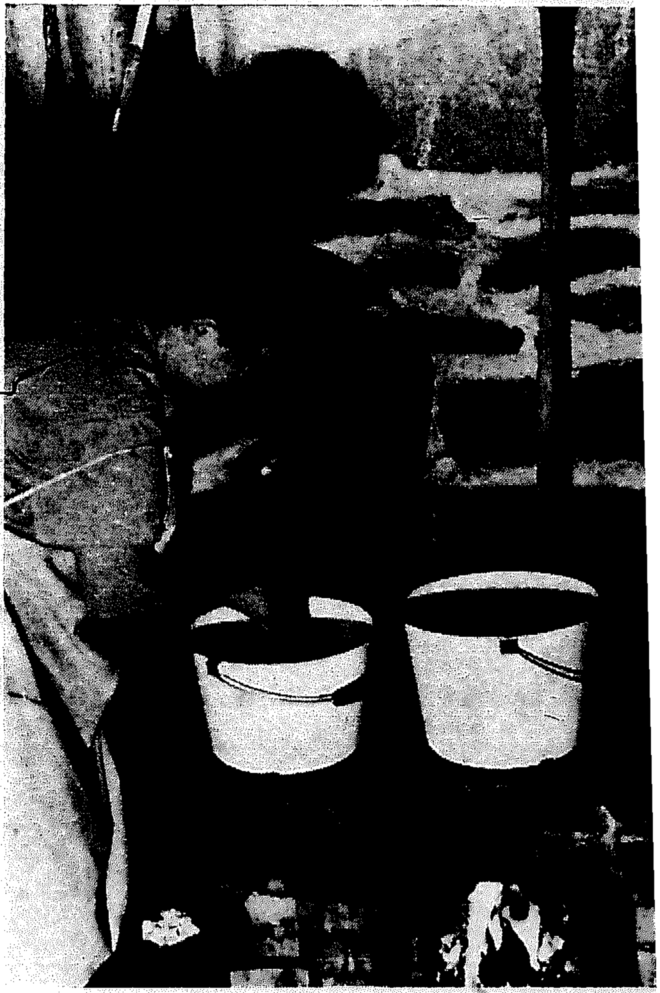
Heat just to the boiling point and let the kettle *simmer* (never boil) for half an hour—or longer if directions require. When water gets low, lift out the wool, add boiling water to reach the original level, stir well, and return the wool to the dye bath. The color that shows on the wet wool should be a trifle darker than the shade desired.

With dyes made from special commercial preparations derived from plants, it is important to keep the water well below the boiling point. While there is color in the water the dye bath may be used, though subsequent batches of wool will be lighter than the first.



Scholtz

The residue of plant materials needs to be strained out of the dye bath before the yarn is put in. Grapes were used in this experiment for a small quantity of dye.



Chase, courtesy Penland

Another scene from the Penland School of Handicrafts. Enamel pails are used for rinsing, each one in succession with a slightly lower temperature, the process continuing until the water is clear.

Rinsing and Drying

Have ready a tub or pail of clear water at about boiling temperature for the first rinsing. Let the second rinsing be less hot, the third a bit cooler. Continue to rinse and cool the wool by degrees until the rinse water is clear.

Remove the wool and squeeze out excess water. Roll it in a towel or other absorbent cloth, shake it out, and complete the drying by hanging it in the shade.

Scholtz and Buhle photos

Upper left: Black walnuts (*Juglans nigra*) growing on a branch. They are now ready to be picked and hulled. *Lower right:* The hulls of black walnuts may be used at once or they may be dried or kept in water for future dyeing projects. With different treatments they give black or rich tones of brown.

Above: Weld (*Reseda luteola*), dried and tied in bundles for later use.

Hints on Dyeing

Dyes prepared from plants gathered in different areas and in different seasons will vary in shade. It is therefore desirable to dye the required quantity all at once rather than to try to match tones later.

Most dye plants can be dried for future use, but some give brighter colors when used fresh. The amount varies according to the color desired.

Barks and roots require longer boiling than parts of herbaceous plants to extract the color, but the dye bath may generally be used again. Most give stronger color in the autumn, but resinous barks are stronger in the spring.

A few dyes: indigo, cochineal, saffron and madder are available at botanical supply houses. Also available are quercitron, a preparation from the inner bark of the black oak (*Quercus nigra*), sometimes sold under a trade name; Osage-orange extract, and extract of fustic or "old fustic" from the bark of *Chlorophora tinctoria,* a mulberry-like tree native to South America and the West Indies. "Young fustic," an extract from the smoke-tree (*Cotinus coggyria*), originally from the Mediterranean region, is actually of greater antiquity, but it is now little used.

When using dyes in extract form or in preparations for mordanting, confusion can be avoided (especially for a beginner) if the proper quantities of mordants for one pound of wool are measured and packed ahead of time in carefully marked envelopes. If less than a pound of wool or other material is to be dyed, it will be found practical to work in quarter-pound lots. For these, the individual packages of mordants will each contain one fourth as much.

In your dyeing activities, keep a complete record of each experience. Make notes of the amount of each mordant, of the part of the dye plant being used, as well as the quantity, and of the time allotted to each step. Always keep a labeled sample of the material dyed. ◆

An introduction to the pages that follow

35 RECIPES FOR THE HOME DYER

Using Temperate Zone plants to achieve a wide range of color

IN the recipes on the next 16 pages, follow directions given in the article immediately preceding (pages 9–15). These are summarized below. Where variations are required, they are specified in the recipes.

Plants to be used are readily available in most parts of the United States except on the Pacific Coast ~~and perhaps~~ in the extreme South, though neither of these areas is lacking in useful dye plants. Some of the species are garden flowers; many are native plants; and a good number are European species that have become established in the United States. Similarly, some of the American natives, as goldenrod, are known in European gardens. Of a few plants (each one noted), extracts are available commercially.

Before Dyeing Starts

Some plants are best used fresh; others are equally good when dried. In dyeing with plants (or other substances) it should be remembered that the process of mordanting, to set the color and make it fast, is as important as the dyeing itself. Customarily, it is done before dyeing. Any different procedure recommended is noted in the recipes that follow. Directions for each of the principal mordants are given on pages 9–13.

General Procedure

How to prepare the dye solution by chopping, then soaking and boiling the plant parts, and straining them out before adding their color to the dye bath, is told on pages 13 and 14. Briefly, here are the basic directions for the actual dyeing of wool:

Have wool clean and moist.

For each pound, use 4 to 4½ gallons of dye bath.

Enter wool when dye bath is lukewarm.

Heat slowly to simmering point and let simmer half an hour (longer if required), moving wool gently back and forth.

If dye bath gets low, lift wool, add hot water, mix in well, and return wool to pot.

Rinse dyed wool first in nearly boiling water, then in several waters of gradually lowered temperatures.

When rinsing water is clear, squeeze moisture out of wool and dry in shade.

Special directions for handling cotton, linen and silk are given on pages 12 and 13. When these materials will accept the same dyes as wool, this fact is mentioned in the recipes. Otherwise, the directions apply to wool, whether fleece, yarn or woven textiles.

Drawings by Eva Melady

RED

Bloodroot **Red**

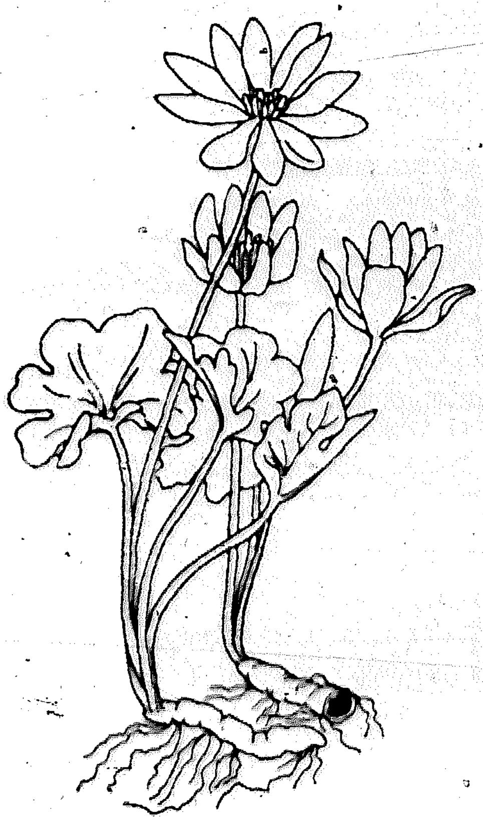
(Sanguinaria canadensis)

The rhizomes ("roots") which are used for dyeing contain a reddish-orange juice which was widely used by American Indians. A large leaf and single flower make the plant conspicuous in spring.

Mordant: Alum.

To prepare the dye: Cut 8 ounces of fresh roots into small pieces, soak an hour, then boil 30 minutes. Strain liquid into bath for dye.

To dye: Heat dye bath until lukewarm. Enter the mordanted, wetted wool. Continue heating slowly and simmer until the desired color is obtained. Rinse thoroughly and dry in shade.



Bloodroot

Ladies' Bedstraw **Red**

(Galium verum)

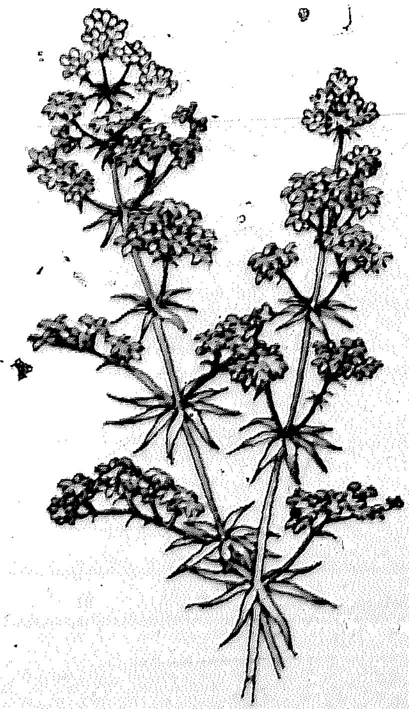
The yellow-flowered European species is frequently seen as a roadside weed. Its thick roots spread out like spokes of a wheel. It is a member of the Madder Family (*Rubiaceae*).

Mordant: For light red, alum; for dull purplish red, chrome.

To prepare the dye: Chop finely one pound of roots, fresh or dried. Soak overnight, then boil one hour. Strain liquid into bath for dye.

To dye light red: When dye bath is lukewarm, enter the alum-mordanted, wetted wool. Continue heating; simmer one hour. Rinse well; dry in shade.

To dye purplish red: Immediately after mordanting with chrome, immerse the still-wet wool in the lukewarm dye bath. Increase heat slowly and simmer about an hour. Rinse thoroughly and dry in shade.



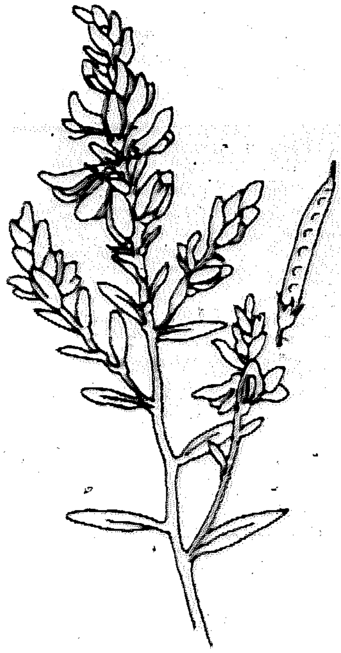
Ladies' Bedstraw

Ladies' Bedstraw **Yellow**

(Galium verum)

The flowering tops of bedstraw produce a good yellow.

Mordant: Alum or chrome. *(Over)*



Dyer's Broom

Ladies' Bedstraw (*continued*)

To prepare the dye: Use one peck of plant material, either fresh or dried and finely cut. Steep overnight in enough water to cover. Boil one hour, then strain into bath for dye.

To dye: Put mordanted, wetted wool into warm dye bath. Bring slowly to a boil and simmer one hour (longer if required for good color). Rinse in several waters of decreasing temperature and dry in shade.

Dyer's Broom **Yellow**

(*Genista tinctoria*)

Also known as wood-waxen and occasionally as woad-waxen, and as dyer's greenweed because of its property of making a good green when dyed over indigo. A Eurasian shrub with yellow pea-like flowers, occasionally found wild in sandy soil between Maine and Washington, D. C.; sometimes planted.

Mordant: Alum or chrome.

To prepare the dye: Boil one pound of flowering tops one hour, then strain liquid into dye bath. If tops are dried, use more than a pound.

To dye: Enter the mordanted, wetted wool when dye bath is lukewarm. Increase heat slowly and simmer one hour. Rinse well and dry in shade.

Scotch Broom

Scotch Broom **Yellow**

(*Cytisus scoparius*)

A yellow-flowered European shrub often planted in gardens; sometimes found as an escape in sandy areas of the eastern United States. The pea-like flowers are close-set against the stiff, erect branches.

Mordant: Alum or chrome.

To prepare the dye: Soak one pound of chopped flowering branches overnight, then boil one hour. Strain liquid into bath for dye. (*Continued on page 19*)

YELLOW

Scotch Broom (*continued*)

To dye: Heat dye bath until lukewarm. Enter mordanted, wetted wool; simmer one hour. Rinse; dry in shade.

On wool that has first been dyed with indigo, Scotch broom produces a good green.

Saffron **Yellow**

(*Crocus sativus*)

For wool or silk

The three long, bright-orange stigmas of this fall-flowering crocus produced the yellow dye used by the Persians, Greeks and Romans in ancient times. An important commodity down through the Middle Ages. Available today, from drug stores, botanical supply houses and Spanish grocery stores.

Mordant: Alum.

To prepare the dye: Gently boil four ounces of dried saffron half an hour. Strain liquid into bath for dye.

To dye: Immerse mordanted, wetted wool or silk in lukewarm dye bath. Simmer wool gently; steep silk at lower temperature (about 160 degrees Fahrenheit) until desired shade is obtained. Rinse carefully and dry in shade.

Saffron

Safflower, Dyer's Thistle **Yellow**

(*Carthamus tinctorius*)

Used chiefly on silk

Also called false saffron and dyer's saffron. Sold generally as American saffron in place of true saffron.

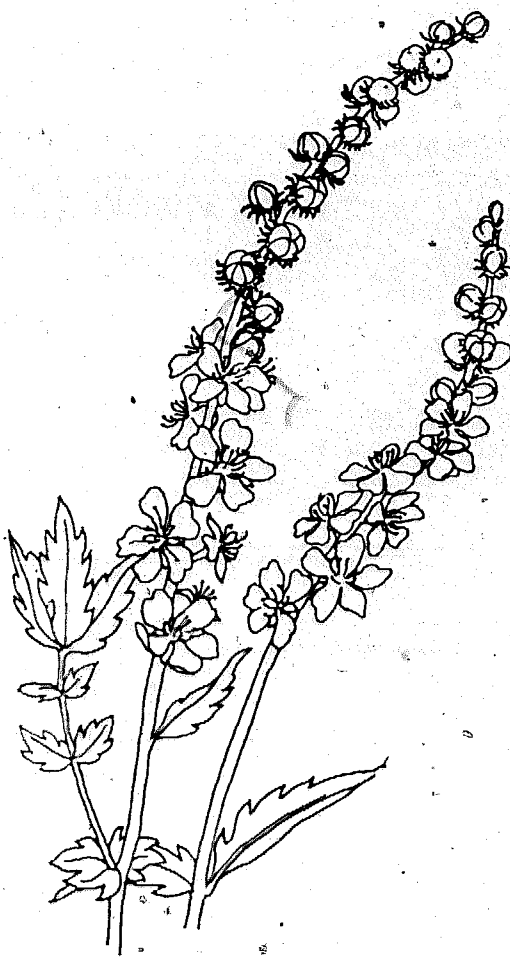
Mordant: Alum.

To prepare the dye: Bring one peck of fresh safflower blossoms to a boil and simmer one hour (use more if flowers are dried). Strain liquid into bath for dye.

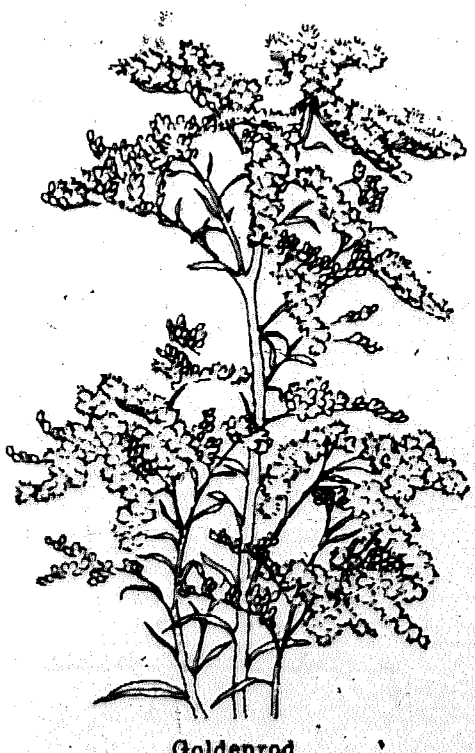
To dye silk: Simmer washed silk very gently for one hour.

To dye wool: Enter mordanted, wetted wool in lukewarm dye bath and boil one hour.

Safflower



Agrimony



Goldenrod

YELLOW — TAN — GOLD

Agrimony — Yellow

(Agrimonia eupatoria)

Sticklewort and church steeples are other names for this European perennial, occasionally seen in gardens and sometimes found in waste places in the northern United States. Gives a fine yellow.

Mordant: Alum or chrome.

To prepare the dye: Boil one peck of chopped leaves and stalks one hour. Strain liquid into bath for dye.

To dye: When dye bath is lukewarm, enter mordanted and wetted wool. Slowly bring to a boil and simmer one hour. Rinse well. Dry in shade.

Goldenrod — Yellowish tan; old gold

(*Solidago* species)

Flowering heads of *Solidago canadensis* or almost any of the related species common to roadsides and fields can be used; pick when coming into bloom.

Mordant: For yellowish tan, alum; for old gold, chrome.

To prepare the dye: Place 1 to 1½ pecks of goldenrod flowers in enough cold water to cover; bring to a boil and boil for one hour or longer to extract their color. Strain liquid into bath for dye.

To dye yellowish tan: Enter alum mordanted, wetted wool in lukewarm dye bath. Continue heating; simmer one hour. Without rinsing, enter wool into a second bath, this one containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Keep wool moving while simmering for 15 minutes. Rinse and dry.

To dye old gold: Enter wet wool in lukewarm dye bath as soon as the chrome mordanting is finished. Simmer one hour after boiling point is reached. Rinse well; dry in shade.

YELLOW — GOLD

Smartweed **Yellow; gold**

(*Polygonum hydropiper*)

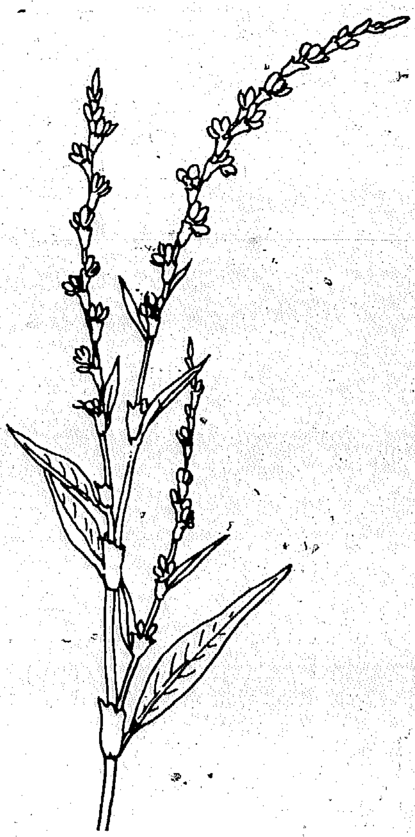
For wool, cotton, linen

Knotweed, water-pepper and red-knees are among the other names for this common weed of damp ground throughout the Northern Hemisphere. J. and R. Bronson, who wrote authoritatively on dyes and textiles in the early 18th century, considered it the most durable yellow dye for wool and more permanent than fustic on cotton. Except for the roots, the entire plant is used.

Mordant: For yellow, alum; for gold color, chrome.

To prepare the dye: Soak one peck of the chopped plant for three or four days, then bring to a boil. Reduce temperature to about 200 degrees Fahrenheit and steep 30 minutes. Strain liquid into bath for dye.

To dye: Enter wetted, mordanted wool, bring to a boil and steep the material one hour in the dye bath. Rinse and dry. With chrome, dye immediately after mordanting. For cotton, use alum-tannic acid-alum mordant (page 12).



Smartweed

Privet **Yellow; gold**

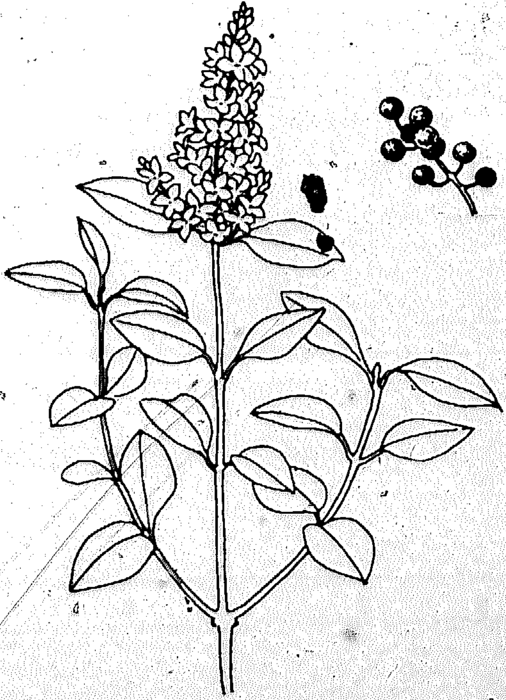
(*Ligustrum vulgare*)

Clippings from the trimming of this common hedge plant can be used for dyeing.

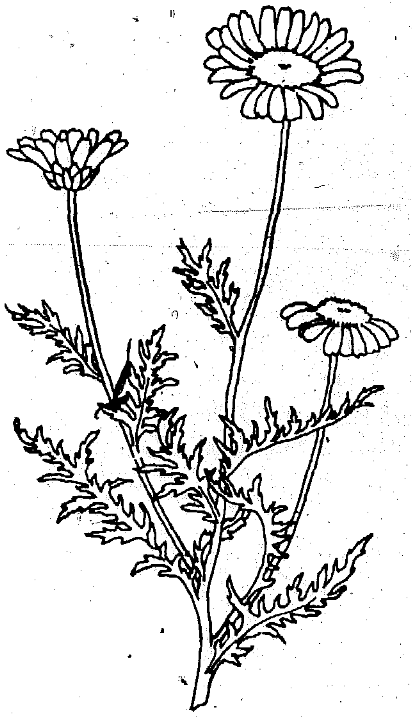
Mordant: For yellow, alum; for gold color, chrome.

To prepare the dye: Soak overnight $1\frac{1}{2}$ pecks of chopped fresh branch tips (clippings). Then heat gradually and boil 30 minutes. Strain liquid into bath for dye and cool before adding wool.

To dye: Gradually heat the mordanted, wetted wool in dye bath and simmer 45 minutes. With chrome, dye immediately after mordanting. Rinse well, as usual, and dry in shade.



Privet



Golden Marguerite

YELLOW — GOLD

Golden Marguerite — **Yellow; khaki; gold**

(*Anthemis tinctoria*)

A yellow-flowered, daisy-like European perennial known as dyer's chamomile, sometimes seen along roadsides in the northern United States and adjacent Canada.

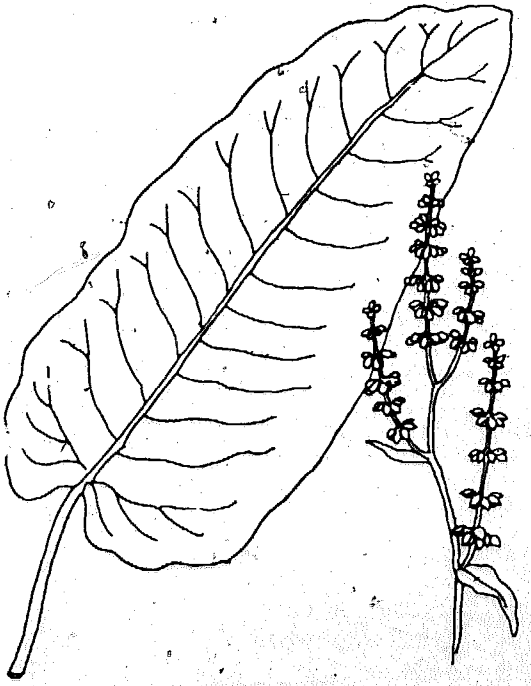
Mordant: For yellow, alum; for khaki, alum plus a second dye bath; for gold-color, chrome.

To prepare the dye: Chop one peck of flower-heads and boil 30 minutes. Strain liquid into bath for dye.

To dye yellow: Enter wetted alum-mordanted wool in cold dye bath; heat slowly and simmer one hour. Rinse well and dry in shade.

To dye khaki-color: After 30 minutes of simmering, as for yellow, enter alum-mordanted wool, without rinsing, in a second boiling bath, this one containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 10 to 15 minutes. Rinse in soapy water.

To dye gold color: Dye soon after mordanting with chrome, while wool is still wet but after it has cooled. Enter in a cold dye bath, bring to a slow boil, and simmer 30 minutes. Rinse in several clear waters of gradually reduced temperatures.



Dock

Dock — **Dark yellow**

(*Rumex obtusifolius*)

A tall, coarse roadside weed, with red-veined leaves at the base; naturalized from Europe and widespread.

Mordant: Alum.

To prepare the dye: Soak ½ pound chopped roots overnight. Boil one hour. Strain liquid into bath for dye.

To dye: Enter mordanted and wetted wool into lukewarm dye bath. Heat to boiling point, then simmer for one hour. Rinse well and dry in shade.

YELLOW — GOLD

Marigold Yellow; buff; old gold

(*Tagetes* varieties)

For wool or silk

Mexican plants of several species with yellow, orange, or red-and-yellow flowers, developed as garden annuals of many varieties.

Mordant: Alum.

To prepare the dye: Cover one peck of fresh flower-heads with cold water. Bring to a boil and boil one hour. A few black walnut hulls boiled with the flowers will deepen the tone of yellow. If dried flower-heads are used, only ¾ peck will be needed. Strain liquid into bath for dye.

To dye wool yellow: Enter the mordanted, wetted wool in a lukewarm dye bath. Heat to the boiling point and simmer 45 minutes to one hour. Rinse, then dry in shade.

To dye wool yellowish buff: After 45 minutes in the first dye bath enter wool, without rinsing, in a second, boiling dye bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, then rinse as usual. Dry in shade.

To dye silk: Enter washed and mordanted silk in lukewarm dye bath. Heat only to 160 degrees Fahrenheit and hold at that temperature 45 minutes or slightly more. Dry the silk before rinsing it.

Marigold

St.-John's-wort Yellow

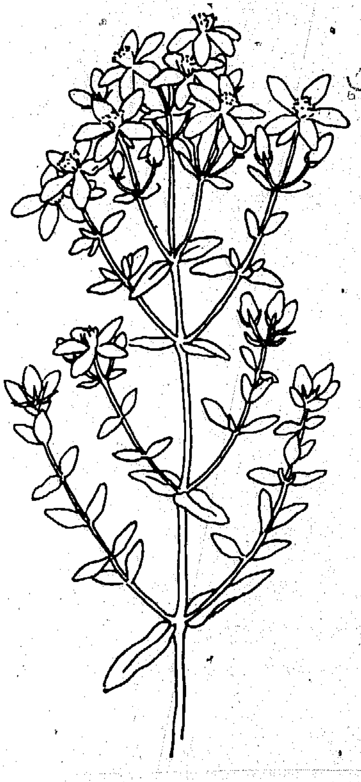
(*Hypericum perforatum*)

A yellow-flowered European weed that has spread to dry fields and waste places throughout the eastern United States and Canada, blooming in early and mid-summer.

Mordant: Alum.

To prepare the dye: Soak one peck of plant tops overnight. Bring to a boil and simmer one hour. Strain liquid into bath for dye.

To dye: Enter mordanted and wetted wool when dye bath is lukewarm. Heat slowly to boil and simmer one hour. Rinse and dry in shade.



St.-John's-wort

Queen-of-the-meadow

Lily-of-the-valley

GREENISH YELLOW

Queen-of-the-meadow
Greenish yellow

(*Filipendula ulmaria*)

A spirea-like perennial plant from Eurasia, grown in American gardens and occasionally escaped into the wild. One of several similar plants called meadowsweet. The whole plant is cut for dyeing. Best used when coming into bloom in summer.

Mordant: Alum.

To prepare the dye: Cover one peck of plant tops with cold water. Gradually bring to a boil and boil one hour. Strain liquid into water for dye bath.

To dye: Enter mordanted, wetted wool into lukewarm dye bath. Heat gradually to boiling point and simmer one hour. Rinse thoroughly; dry in shade.

Lily-of-the-valley
Greenish yellow; gold

(*Convallaria majalis*)

Only the leaves of this spring-flowering garden plant are used for dyeing. Those gathered in spring give a pale greenish yellow; in autumn, gold.

Mordant: Chrome.

To prepare the dye: Soak one peck of chopped leaves overnight, bring slowly to a boil and boil one hour. Strain liquid into bath for dye.

To dye: Enter the wool, just mordanted and still wet, in lukewarm dye bath; heat slowly and simmer one hour. Rinse and dry in shade.

Broomsedge Greenish yellow; brass

(*Andropogon virginicus)*

A field and roadside grass about 3 feet tall, common throughout the eastern half of the United States. It can be dried, but is stronger in color if gathered in summer and used while fresh.

Mordant: For greenish yellow on wool, alum; for brass color, chrome. For yellow on cotton, alum-tannic acid-alum (see page 12).

(*Continued on page* 25)

Broomsedge (*continued*)

To prepare the dye: Chop ¾ peck of stalks and leaves. Boil two hours and strain liquid into bath for dye.

To dye greenish yellow: Use alum-mordanted wool. Wet it, place it in a warm dye bath, and bring slowly to the boiling point. After 30 minutes at this temperature enter wool directly, without rinsing, into a second bath, this one containing 1/6 ounce copper sulfate and 1/6 ounce acetic acid. Simmer 15 minutes. Rinse and dry in the shade.

To dye brass color: Dye the still-wet wool immediately after mordanting with chrome. After reaching the boiling point, let the kettle simmer half an hour. Then rinse the wool thoroughly and dry in shade.

For other colors on wool: Broomsedge can be used over indigo to obtain green; over madder for henna. For dyeing with indigo and madder, see pages 33-35.

To dye cotton yellow: Use alum-tannic acid-alum mordant (see page 12). Put wet cotton into warm dye bath, bring to a boil, and boil 30 minutes or longer for desired shade of yellow. Rinse and dry in shade.

Broomsedge

Nettle **Greenish yellow**

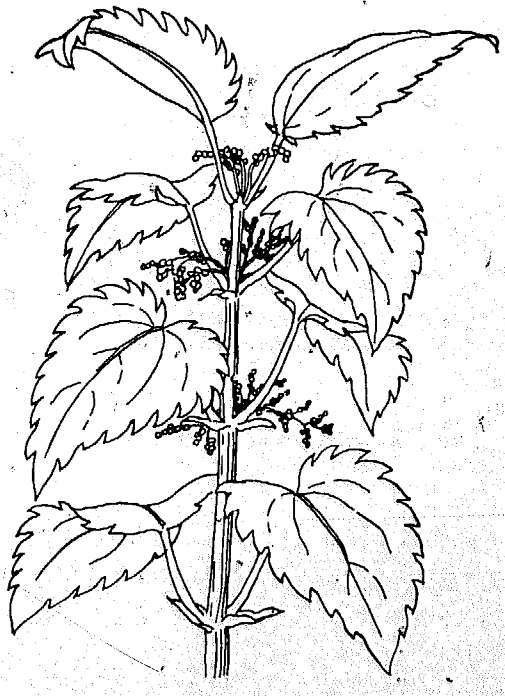
(*Urtica dioica*)

This irritatingly prickly weed of wide distribution on several continents is satisfactory as a dye plant; but wear gloves when gathering it to avoid contact with its stinging hairs.

Mordant: Alum.

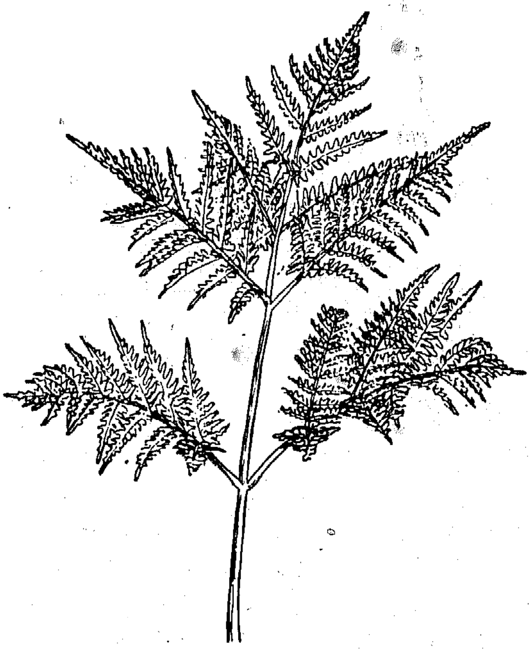
To prepare the dye: Chop the whole plant (except the roots) and boil one hour. Strain liquid into bath for dye.

To dye: Enter the mordanted, wetted wool when dye bath is lukewarm. Bring to a boil and simmer 30 minutes. Rinse and dry.



Nettle

YELLOW GREEN, GRAY GREEN



Bracken

Bracken, brake
Yellowish green; also gray on silk

(*Pteridium aquilinum*)

For wool or silk

A coarse fern of nearly world-wide distribution, bearing a single broad frond. Best used for dyeing at the "fiddlehead" stage in spring when the young shoots are still coiled at the tip.

Mordant: Alum or chrome.

To prepare the dye: Steep one pound of young shoots in hot water for two hours. Strain liquid into bath for dye.

To dye yellowish green: Enter mordanted, wetted material into lukewarm dye bath. If wool, simmer one hour. If silk, heat only slightly and hold at about 160 degrees Fahrenheit for one hour. Rinse and dry.

To dye silk gray: See **page 32.**

Bayberry **Gray green**

(*Myrica pensylvanica*)

The woody plant of the eastern United States from whose small waxy fruits bayberry candles are made.

Mordant: Alum.

To prepare the dye: Pick leaves in summer. Soak ½ pound overnight, then boil half an hour or longer to extract color. Strain liquid into bath for dye.

To dye: Enter alum-mordanted, wetted wool into dye bath, increase heat slowly, and boil 30 minutes. Rinse and dry.

Sumac **Yellowish tan; gray**

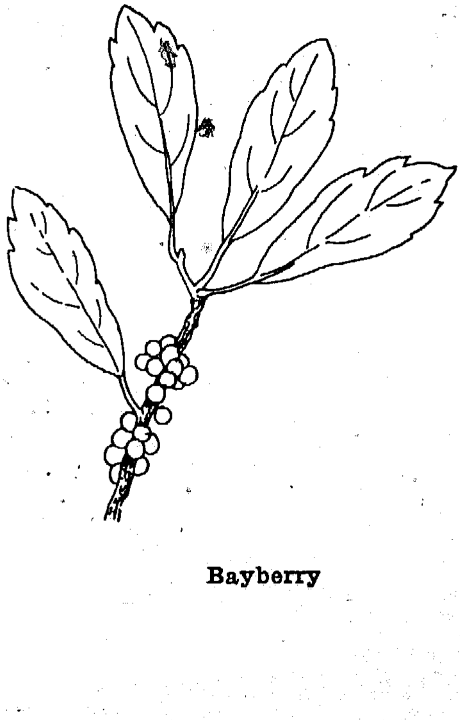
(*Rhus glabra*)

For wool or cotton

Leaves, shoots, bark and roots, as well as the fuzzy red "berries" of sumac all have dyeing properties. (For use of the leaves and shoots, see page 29). This sumac is similar to the dyers' sumac (*Rhus coriaria*) of Europe, which was imported as a dyestuff in colonial days.

Mordant: For yellowish tan, alum; for gray, ferrous sulfate in dye bath.

(*Continued on page 27*)



Bayberry

YELLOWISH TAN

Sumac (*continued*)

To prepare the dye: Crush ½ peck of ripened (red) sumac fruits. Soak overnight, then boil 30 minutes. Strain liquid into bath for dye.

To dye yellowish tan: Enter wetted, alum-mordanted wool or cotton into dye bath. Heat to boiling point, then simmer 45 minutes. Rinse well and dry in shade.

To dye gray: No previous mordanting necessary. Add 1/6 ounce ferrous sulfate to lukewarm bath immediately after adding dye. Enter wetted wool when boiling, and simmer not more than 30 minutes. Rinse at once and dry in shade.

Osage-orange Yellowish tan; gold

(*Maclura pomifera*)

For wool or cotton

Osage-orange, a shrubby tree of the Mulberry Family, originally from Texas and Arkansas, widely planted elsewhere as a hedge and hardy in the north. This was one of the dyes used for khaki uniforms during the First World War. An extract from the bark is available from dye supply houses. It contains the same principle as fustic.

Mordant: For yellowish tan, alum; for gold-color, chrome.

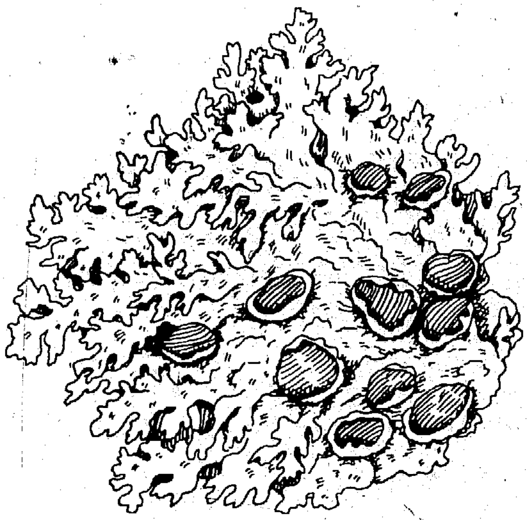
To dye yellowish tan: Dissolve ½ ounce extract in a warm dye bath. Add alum-mordanted and wetted wool; heat slowly, and simmer 30 minutes. Remove wool and, without rinsing, immerse it in a second boiling bath (again 4 to 4½ gallons of water) containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, moving the material slowly but constantly. Then rinse and dry.

To dye gold color: Dissolve ½ ounce extract in a warm dye bath. Enter the wet wool soon after mordanting with chrome. Heat slowly, then simmer one hour or longer, according to the depth of gold desired. Rinse and dry.

For cotton: Use alum-tannic acid-alum mordant (page 12) and follow dyeing directions given for yellowish tan.

Sumac

Osage-orange



Lichen

Lichen **Tan**

(*Parmelia conspersa*)

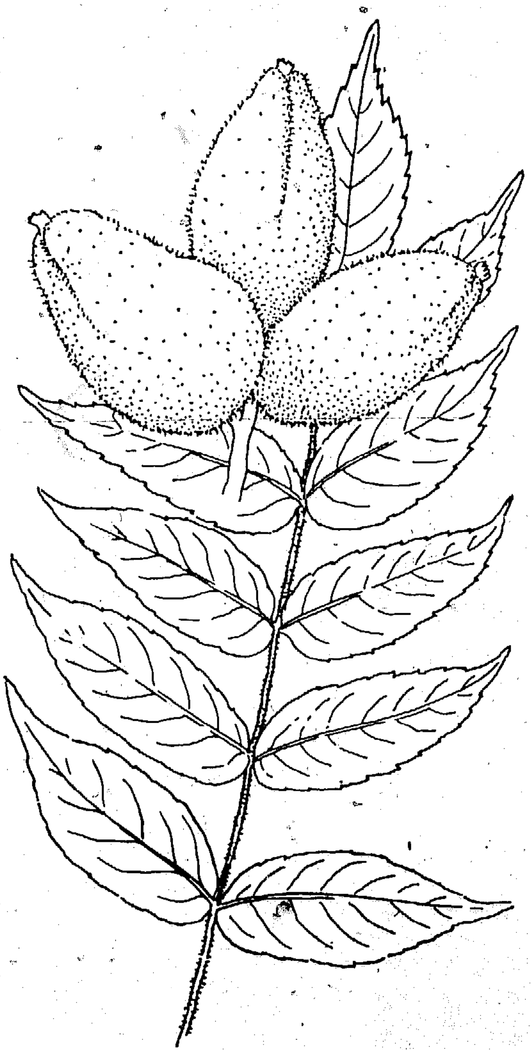
Many lichens can be used for dyeing, among them this flattish gray lichen that is common on rocks in New England and elsewhere. They are most easily cut from the rocks after rain, when they are soft. Wash them and dry them for future use. Those gathered in August give the strongest colors.

Mordant: Alum.

To prepare the dye: Soak one peck of lichens overnight. Boil one hour and strain liquid into bath for dye.

To dye yellowish tan: Enter alum-mordanted and wetted wool when dye bath is lukewarm. Continue heating to a boil, then simmer half an hour or longer. Rinse as usual and dry wool in shade.

To dye rose tan: After 30 minutes of simmering, remove wool and, without rinsing, put it into a hot bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, then rinse and dry.



Butternut

Butternut hulls **Tan**

(*Juglans cinerea*)

Butternuts should be gathered from the trees while the hulls are still green.

Mordant: None.

To prepare the dye: Remove the hulls by pounding them with a hammer against a flat stone. (Use rubber gloves to prevent stained hands.) When a peck has been amassed, soak the hulls overnight, then boil one hour and strain liquid into bath for dye.

To dye light tan: Wet wool and immerse it when the dye bath is lukewarm. Continue heating slowly to a boil and simmer one hour. Rinse and dry.

To dye dark tan: After 30 minutes of simmering, remove wool and, without rinsing, put it in a boiling water bath containing 1/6 ounce ferrous sulfate. Simmer 15 minutes. Rinse well and dry in shade.

To dye cotton gray: See page 32.

TAN — BROWN — BLACK

Sumac Tan to dark brown

(*Rhus glabra*)

For wool or cotton

Leaves and young shoots of sumac contain a large amount of tannin. Since tannic acid is a mordant, no previous mordanting is required.

To prepare the dye: Gather leaves and shoots (only the current season's growth) in late summer and dry them like hay. Before using, cut them finely, soak overnight in enough water to cover, and boil 30 minutes or more. Strain liquid into bath for dye.

To dye: Wet the material and enter into lukewarm dye bath. Heat gradually to a boil and simmer until the desired shade is obtained.

(For yellowish tan from sumac berries, see page 27.)

Black walnut Dark brown; black

(*Juglans nigra*)

One of the oldest of home dyes in North America; also widely used on other continents where black walnuts have been planted. The nuts are collected while the hulls are still green. Remove the hulls (see directions for butternut hulls, above), cover them with water, and store them away from the light until ready for use. Or, dry them at once and store for future dyeing. Best used on coarse wools.

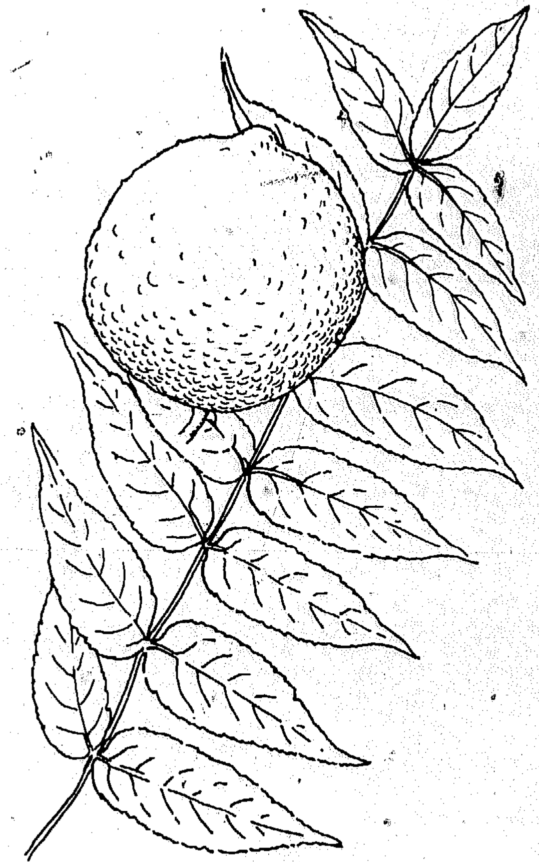
Mordant: None required, but a richer color obtained if one is used.

To prepare the dye: Soak 6 quarts of hulls overnight and boil two hours before straining liquid into bath for dye.

To dye: Immerse wetted wool when dye bath is lukewarm. Heat to boiling point and simmer one hour.

To darken the color: Add a few sumac berries and a pinch of copperas (ferrous sulfate). The dye bath can be used several times over, each time giving a slightly lighter tone.

To obtain black: Dye wool first with indigo (see page 33) to get a deep blue. Rinse wool thoroughly, then enter into dye bath of black walnut as for dark brown. Add a handful of sumac berries. Simmer one hour. Leave overnight in dye bath. If not dark enough, next day add more black walnut dye and a pinch of copperas. Heat again to boiling point and simmer until color is right. Rinse thoroughly and dry in shade.



Black Walnut

Black walnut Drab

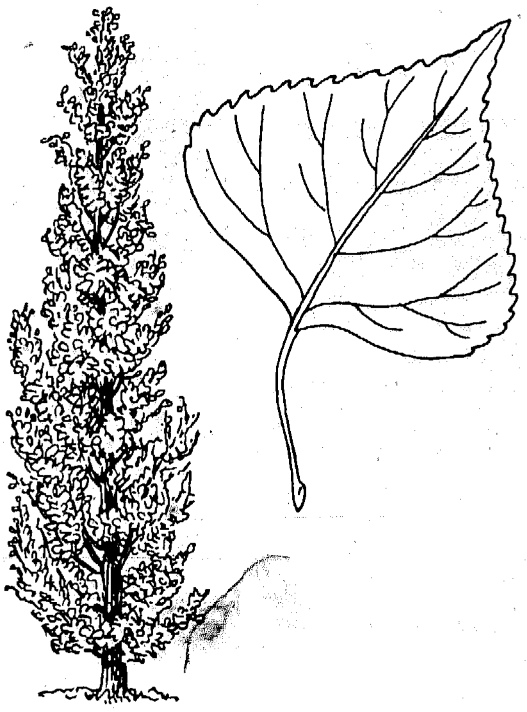
(*Juglans nigra*)

For cotton

Mordant: Alum-tannic acid-alum (p. 12).

To prepare the dye: Follow directions for dark brown on wool.

To dye: Boil cotton 45 minutes in dye bath. Rinse well and dry. For a darker shade use a second bath of boiling water containing ½ ounce ferrous sulfate. Boil 15 minutes. Rinse and dry.



Lombardy Poplar

YELLOW — GOLD — ORANGE

Lombardy poplar
Lime yellow; golden brown

(*Populus nigra italica*)

The frequently planted Lombardy poplar of Europe has become naturalized in parts of the eastern United States. The leaves give distinctive colors with different mordants.

Mordant: For lime yellow, alum; for golden brown, chrome.

To prepare the dye: Chop 1½ pecks of leaves and soak overnight. Heat gradually and boil 45 minutes to an hour. Strain liquid into bath for dye.

To dye lime yellow: Enter alum-mordanted, wetted wool into lukewarm dye bath. Heat to boiling point and simmer until color is right. Rinse; dry in shade.

To dye golden brown: Soon after mordanting with chrome, enter wet wool into dye bath. Continue heating and simmer until the desired color is obtained. Rinse well and dry in shade.

Black Oak Buff; gold; orange

(*Quercus velutina*)

For wool, cotton, silk

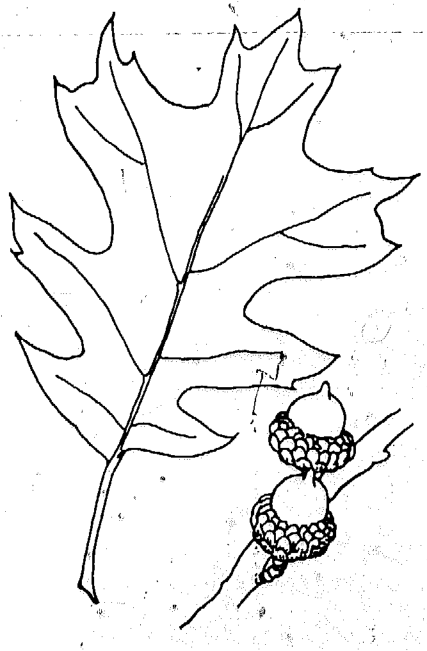
If you wish to use fresh oak bark, strip bark from the trees (preferably recently felled trees) in the spring. Remove outside and retain inner bark, which is soft. Put it in an airy place. When dry, it can easily be powdered. Since it is high in tannin, a mordant is not essential, but it is generally advantageous to use one.

Quercitron, an extract made from the powdered inner bark of black oak, is available in dye supply houses, and is easier to handle.

Mordant: For buff, alum; for gold color, chrome; for orange on silk, tin.

To dye buff: Dissolve ½ ounce extract in the dye bath. Enter alum-mordanted, wetted wool; heat slowly, and simmer 30 minutes. Remove wool and, without rinsing, immerse it in a water bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes. Rinse well and dry.

(*Continued on page* 31)



Black Oak

Black Oak (*continued*)

To dye gold color: Dissolve ½ ounce extract in the dye bath. Enter wet wool which has just been mordanted with chrome. Heat slowly and simmer one hour. Rinse well and dry.

To dye orange on silk: For the dye bath mix 2 ounces of quercitron, 1 ounce of tin (stannous chloride) and ½ ounce oxalic acid in the usual 4 to 4½ gallons of lukewarm water. Enter the washed silk and steep for one hour. Remove silk and add to the bath 1 ounce of tin, 1 ounce oxalic acid, and 2 ounces of cochineal. Heat to 160 degrees Fahrenheit and let the silk steep in this for another hour. Dry silk before rinsing.

Coreopsis, calliopsis

Burnt orange; bright yellow

(*Coreopsis tinctoria*)

There are many species, wild and cultivated. In the South, one kind is called the dye-flower.

Mordant: For burnt orange, chrome; for bright yellow, tin and cream of tartar.

To prepare the dye: Boil 1 to 1½ pecks of fresh flower-heads 20 to 30 minutes. Strain liquid into bath for dye.

To dye burnt orange: As soon as wool has cooled after mordanting with chrome, enter it into a cool dye bath and bring to a boil at once, then slowly simmer until the color suits. Rinse and dry.

To dye bright yellow: For mordanting, dissolve ½ ounce stannous chloride and ½ ounce cream of tartar and add to 4 to 4½ gallons of warm water. Enter wetted wool and simmer half an hour, keeping the wool covered all the while.

Prepare the dye bath as for burnt orange. Enter the mordanted wool without rinsing. Bring to a boil at once and continue gently boiling until the desired color is reached. Rinse in soapy water and dry in shade.

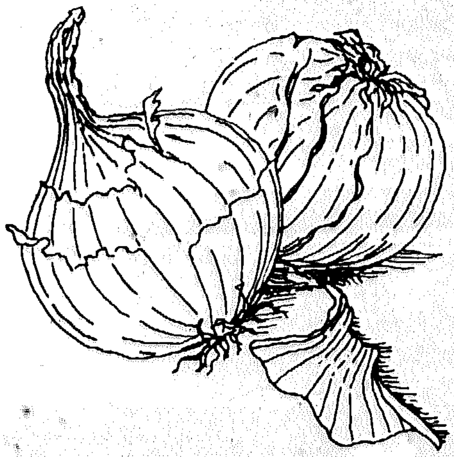
Onion

Burnt orange; brass

(*Allium cepa*)

Only the papery brown skins of the common cooking onion are used.

Coreopsis



Onion

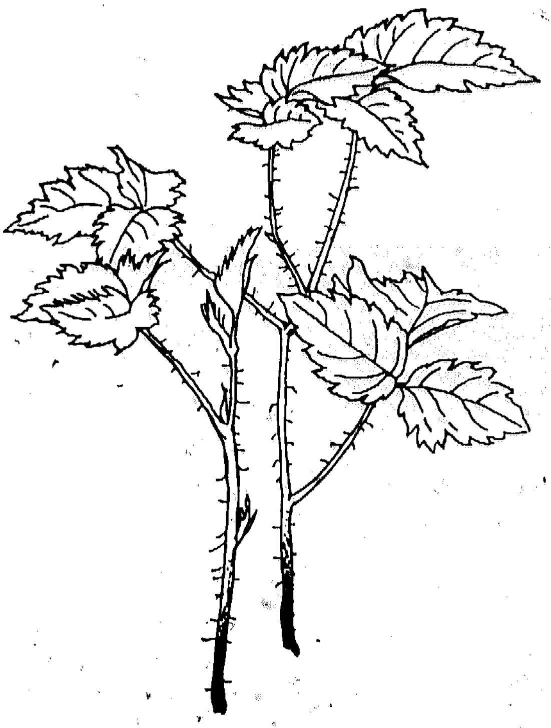
Mordant: For burnt orange, alum; for brass color, chrome.

To prepare the dye: Boil one pound of skins 30 minutes. Strain liquid into bath for dye.

To dye burnt orange: Steep alum-mordanted, wetted wool one hour in hot dye bath. Rinse and dry. To make the color more durable, dip the wool two or three times more in the dye bath, drying it after each dipping.

To dye brass-color: Immediately after mordanting with chrome, enter the still wet wool in the warm dye bath and steep until the desired tone appears. Rinse and dry.

GRAY



Blackberry

Bracken, brake Gray

(*Pteridium aquilinum*)

For silk

Mordant: Iron.

To prepare the dye: Boil one pound of fern shoots 30 minutes and strain liquid into warm dye bath. Enter washed, wet silk and steep one hour. Remove silk; cool dye bath and add one ounce ferrous sulfate and two ounces cream of tartar. Mix well; return silk to bath, heat gradually to boiling, reduce to 160 degrees Fahrenheit, and steep half an hour longer. Dry silk before rinsing.

(For bracken dyes on wool, see page 26.)

Blackberry Light gray

(*Rubus* species)

For wool or silk

Young shoots of the common brambles of roadsides and waste places can be gathered in the spring for dyeing.

Mordant: Alum.

To prepare the dye: Boil one pound of young blackberry shoots 45 minutes. Strain liquid into bath for dye.

To dye wool: Immerse wool when dye bath is lukewarm, bring to a boil and simmer one hour. If a darker gray is wanted, lift wool out and add ½ ounce iron (ferrous sulfate) to the dye bath. Mix in well; return wool and continue simmering until the shade desired is obtained. Rinse and dry.

To dye silk: Enter washed and mordanted silk into lukewarm dye bath. Heat to about 160 degrees Fahrenheit and hold at that temperature for one hour. Dry silk before rinsing it.

Butternut hulls Gray

(*Juglans cinerea*)

For cotton

Mordant: Alum-tannic acid-alum.

To prepare the dye: Follow directions for tan on wool (page 28).

To dye: Enter mordanted cotton into dye bath as for wool. After boiling 30 minutes, remove cotton and, without rinsing, put it in a boiling water bath containing 1/6 ounce ferrous sulfate. Boil 15 minutes. Rinse and dry. ◆

Sources of Dried Plant Parts and Other Dyestuffs

HOME craftsmen wishing to obtain commercially prepared plant dyes in small quantities will find very few distributors handling them.

DYES AND CHEMICALS

Darrell Bailey, 15 Dutton Street, Bankstown, New South Wales 2200, Australia.
Kem Chemical Co., 545 S. Fulton Street, Mt. Vernon, New York 10550.
Straw into Gold, 5500 College Avenue, Oakland, California 94618.
World Wide Herbs, Ltd., 11 St. Catherine Street East, Montreal, Canada.
Catalogues available from the above firms.

YARN

Wm. Condon & Sons Ltd., 65 Queen St., P. O. Box 129, Prince Edward Island, Canada.
Briggs & Little's Woolen Mill Ltd., Harvey Station, New Brunswick, Canada.

DYES OF ANCIENT USAGE

INDIGO and woad for blue, madder for red, weld for yellow, and cutch (catechu) for brown are among the oldest dye plants known to Eurasian civilizations. While aniline dyes have supplanted them for general commercial use, several of the natural plant dyes still have a limited, specialized place in the dyeing industry today. And all are of interest to home dyers who choose plants in place of manufactured powders as their source of coloring. Woad, however, is not easily handled by the amateur.

In the New World, two of the oldest dye plants are logwood and fustic, both rather small trees from the tropical Americas. Extracts from the wood of these trees (fustic for tones of yellow, logwood for various dark colors) are available today for home dyers as well as for industry.

Notes on these long-known dye plants, with directions for their use, are given here.

Indigo

Blue

(Indigofera tinctoria)

Indigo is a delicate-appearing shrub of the Legume, or Pea, Family with oval leaflets and spikes of tiny reddish-yellow flowers. Long known for the clarity and fastness of the blue that it produces, it spread in use at an early date from the East Indies throughout the ancient world.

Production of the dye depends on fermentation of the leaves. Leaf-bearing branches are cut from the plant, immersed and allowed to remain in water for the fermentation period. The paste which settles on the bottom of the vessel is processed into cakes, which must be finely ground before being used. The color develops only when the material being dyed is exposed to air. Most craftsmen purchase indigo powder ready to use.

There are several methods for obtaining a permanent blue color from indigo. Most dyers find the hydrosulfite vat most satisfactory. Directions for preparing a stock solution of dye, as given in the U.S. Department of Agriculture's Miscellaneous Publication No. 230, *Home Dyeing with Natural Dyes* by Margaret S. Furry and Bess M. Viemont, are quoted here:

> A stock solution is made up as follows:
> 4¼ ounces powdered indigo
> 3 ounces sodium hydroxide [caustic soda]
> 2¾ ounces sodium hydrosulfite
>
> Mix the powdered indigo with the sodium hydroxide which has been dissolved in water. Add water to make one gallon and heat to 120 degrees Fahrenheit. Stir well and add the sodium hydrosulfite slowly. Let stand for 30 minutes. The liquid should be clear and yellow, and a drop running on a sheet of glass should require about 25 seconds to turn blue. Extra stock solution may be kept in a stoppered bottle.

The next step: Into a quart jar of water slowly pour one-half ounce of sodium hydrosulfite. Keep the solution tightly stoppered.

To dye dark blue. Heat the dye vat to 120 degrees Fahrenheit, add one-half cup of hydrosulfite from the quart jar and let stand 30 minutes. Then add 2½ quarts of the indigo-hydrosulfite stock solution. Let stand 20 minutes before entering the wetted wool. For even dyeing, keep the dye bath between 120 and 130 degrees Fahrenheit. Keep the wool submerged, stirring it for 30 minutes. Without squeezing, hang outside for 30 minutes.

Many dips will produce darker shades, so continue with the dye vat and airing until the desired color is obtained.

When finished, rinse in a light acetic acid bath, then in hot soap suds and clear water.

The reason for the extra stock solution and the quart jar of sodium hydrosulfite solution is to restore the dye vat's contents, if necessary, to proper consistency.

If the vat turns blue, add 3 ounces from the jar of sodium hydrosulfite, stir gently and let stand 30 minutes before using. Add more indigo-hydrosulfite stock if needed.

Woad Blue

(*Isatis tinctoria*)

When Roman invaders under Julius Caesar crossed what is now known as the English Channel in 55 B.C., they are reported to have found a race of men who stained their bodies blue. The woad plant provided the dye. Consequently, generations of Latin students and others exposed to Caesar's *Gallic War* have associated the woad plant solely with the British Isles. But this rather tall, yellow-flowered member of the Mustard Family is widely distributed in Europe and Asia, as well as in North Africa. In Egypt it was being cultivated early in the Christian era.

Today it is rarely used, for preparation of the dye is complicated. In "The Woad Plant and its Dye" (Oxford University Press, London, 1930), Jamieson B. Hurry tells how it was made during the height of commercial woad production in England (13th to 16th centuries).

The leaves were ground by enormous wooden rollers which were drawn round and round by horses, each led by a man. When reduced to a pulp, the mass was separated into heaps for draining. Next, by kneading and rolling, it was formed into balls, two handfuls in each. The balls were dried on racks from one to four weeks. The same rollers that had pulped the leaves then ground the balls to powder.

This powder was conveyed to an enclosure called a couching house, which had a stone floor, on which it was piled in a layer two or three feet deep and sprinkled with water. For nine weeks it was left to ferment, being sprinkled and turned frequently. A dark clay-like substance resulted, one-ninth of the bulk of the original leaves. This was the dye.

The medieval method of dyeing with woad was to make an aqueous solution, add alum or potash as a mordant, heat the mixture and hold for three hours. The material was then immersed, moved to and fro, and removed when the color was uniform. As with indigo, the material would not show blue when first taken out of the dye pot. The color is brought out by the oxygen of the air.

Woad was formerly used to assist the fermentation process of indigo. It is rarely available today, but by those who grow it as a garden biennial or perennial, the plant is prized for the abundance of yellow it brings to the spring scene.

Madder Red

(*Rubia tinctorum*)

For wool, cotton, linen and silk

Madder gives the best and most enduring red dye of any plant. It is Eurasian in origin and is of ancient usage.

The several stems of the madder plant are more or less procumbent and they bear their narrow leaves in circles (whorls) at intervals, in the same manner as bedstraw (*Galium*), but larger. Also as in some kinds of bedstraw, which likewise belong to the Madder Family, the leaves are roughly prickly on their lower surfaces and margins. Minute yellow flowers occur in loose, spidery clusters above the whorls of leaves and at the tip.

After three years' growth, the long fleshy roots are dug, cleaned and dried, then ground. This is the only red dye for which hard water is recommended. If only soft water is available, add a little slaked lime (calcium hydroxide).

Mordants: Different color tones can be achieved with different mordants. For lacquer red, use alum; for garnet red, chrome.

To prepare the dye: Soak 8 ounces of powdered madder root overnight. Bring to a boil, then immediately strain through gauze into water for dye.

To dye wool lacquer red: Immerse alum-mordanted and wetted wool in lukewarm dye bath. Bring slowly to a boil during 1½ hours. Reduce heat at once to 190 degrees Fahrenheit and simmer 45 minutes. Never let the dye bath boil.

Cool to permit easy handling, then rinse. To the last rinse water add ½ ounce (two tablespoons) of mild soap flakes to each gallon to brighten the color. (Instead of the soap flakes, a handful of bran for each pound of wool in the dye bath itself will also add brightness.)

To dye wool garnet red: Immediately after mordanting with chrome, immerse the wool in the dye bath and keep it covered. Follow the same dyeing directions as for lacquer red.

To dye cotton and linen: Use alum-tannic acid-alum mordant (see page 12). Immerse wetted material in dye bath and slowly raise the temperature to 200 degrees Fahrenheit and keep it at 200 degrees for one hour. Lift yarn and add one-third ounce baking soda, return yarn and continue one-half hour at 200 degrees. Rinse as for lacquer red.

To dye silk: Mordant with alum. Prepare dye bath as above; add one ounce of bran. Immerse wet, mordanted silk, and slowly bring to a boil during one hour. Simmer 10 to 15 minutes. Follow with a bath of warm soapy water (two ounces of soap per gallon) with one teaspoon of stannous chloride added for brightening. Use rinse waters of temperatures that are gradually reduced. The final rinse is in cold water.

Weld

Yellow; old gold

(*Reseda luteola*)

For wool and silk

Weld, or dyer's mignonette, is a tall annual herb that is native throughout the Mediterranean region. It is considered to be of greater antiquity than any other yellow dye. The color derived from the plant is of great permanence. On wool this dye imparts softness to the texture.

The flowers, in themselves inconspicuous, are borne in long, very slender, erect spikes. The plant should be gathered when in full flower but before the blossoms fall. If used at once the color will be brighter, but the plant instead may be dried for future dyeing.

Mordants: For lemon yellow on wool, alum; for golden yellow, chrome; for orange, alum and tin; for yellow on silk, chrome.

To prepare the dye: Put one pound of plant material in cold water, bring to a boil and simmer two hours. Strain into bath for dye. For deeper shades of yellow, use more plant material.

To dye wool lemon yellow: Immerse alum-mordanted, wetted wool in dye bath. Let it simmer 1½ hours. For a richer color, add one ounce of powdered chalk (calcium carbonate) near the end of the period.

To dye wool golden yellow or old gold: Mordant wool with chrome and dye immediately, placing wet wool in warm dye bath and keeping it submerged. Bring to a boil, and simmer for 1½ hours.

To dye silk yellow: Wash silk and mordant it with one ounce dichromate of potash, letting it simmer, covered, one hour at a low temperature (140°). Immerse it immediately in dye bath and simmer, covered, another hour.

To dye wool orange: Madder or cochineal is added to the final dye bath. Mordant wool with alum. Wet it well before immersing it in dye bath of weld. Simmer one hour. Remove wool in order to add tin (one teaspoon of stannous chloride) to the dye bath. Stir in well; return wool, and simmer one-half hour longer. Remove wool again and place it in a separate bath containing ¼ ounce of prepared madder or cochineal. Simmer 30 to 45 minutes longer for the desired color. Rinse well and dry in shade.

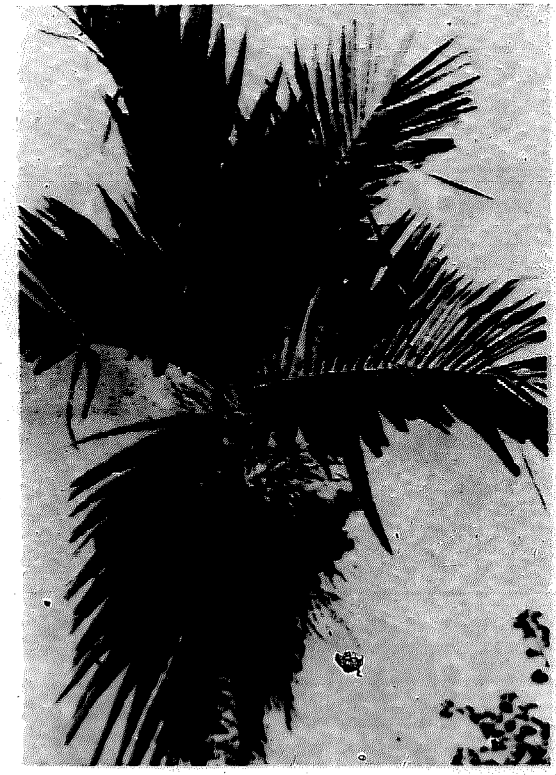
Cutch; catechu

Brown

(*Acacia catechu*)

For wool or cotton

Chips of the heartwood of this and similar species of *Acacia* growing in southeastern Asia and the East Indies are boiled to make a gum resin which is the



Hodge

The nutlike fruits of the betel palm (*Areca catechu*) are one source of the brown dye known as cutch or catechu.

base for a dye. Extract of cutch is available from botanical and dye supply houses. The rich brown which it produces is especially good on wool; on cotton it is said sometimes to fade. For either material, here are the directions given in *Home Dyeing with Natural Dyes* by Furry and Viemont (U.S. Department of Agriculture Miscellaneous Publication No. 230):

> For each pound of dry wool or cotton, allow:
>
> 4 ounces cutch
> ½ ounce copper sulfate
> ½ ounce potassium dichromate
>
> Boil the cutch and copper sulfate in water until well dissolved. While still hot, put in the yarn or cloth which has been boiling a short time in clear water, stir well, and let stand overnight. In the morning squeeze the material from the cutch solution and put it into a hot bath made by dissolving the potassium dichromate in 4 to 4½ gallons of soft water. Stir well and let stand in this for 45 minutes just below boiling temperature. Rinse and dry.

An extract of the betel-nut, which is the fruit of *Areca catechu*, an Asiatic palm, is another source of cutch, or catechu, as a dye. In fact, under the name of "Bombay catechu" it is especially recommended by Ethel Mairet in *A Book on Vegetable Dyes* (published by Douglas Pepler, Hammersmith West (London), second edition, 1917).

Fustic Yellow

(*Chlorophora tinctoria*)

For wool or cotton

Two dye-producing plants are known as fustic: *Chlorophora tinctoria*, a large tree of the Mulberry Family, native in tropical America, and *Cotinus coggygria* (*Rhus cotinus*), a large shrub of southern Europe, planted throughout the Temperate Zone as an ornamental.

The yellow wood of "old" fustic (*Chlorophora tinctoria*) yields a yellow dye which is also used in producing browns and greens. Extract of this kind of fustic is available for dyeing.

Mordant: For gold-color on wool, chrome; for yellowish tan on wool, alum; for a lighter yellowish tan on cotton, alum-tannic acid-alum.

To prepare the dye: Dissolve ½ ounce fustic extract in enough water for the dye bath (4 to 4½ gallons for one pound of wool).

To dye wool gold-color: Immediately after mordanting with chrome, rinse the wool, squeeze out the water, and immerse in dye bath. Bring to a boil, and simmer half an hour. Rinse thoroughly in several waters and dry in shade.

To dye wool or cotton yellowish tan: Wet the mordanted material, immerse in dye bath, and bring to a boil. After half an hour of simmering, remove the material, and without rinsing, immerse it in a boiling water bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Boil ten minutes in this, then rinse well and dry in shade.

One pound of finely cut fustic chips tied loosely in a bag may be used in place of the extract, but two hours of boiling will then be required.

The other fustic, known as "young fustic" (though in much longer use as a dye plant than the American fustic-tree), is also called Venetian sumac and smoke-tree. It is frequently planted as a hardy ornamental shrub. The color that it gives is less permanent than that of *Chlorophora*, so it is seldom used today.

Logwood Gray; gray-blue

(*Haematoxylon campechianum*)

From the earliest days of world commerce in the products of the Americas, logwood chips for dyeing have been an important commodity. They produce gray, brown, black and blue. Their principal use today is for black, achieved with alum and iron, and for making ink.

The logwood tree is a relatively small one with a number of trunks. It was first known from the Bay of Campeche on the east coast of Mexico, but is common in many parts of tropical America. (See illustration, page 53.) It belongs to the Legume Family.

The recipes for gray and gray-blue given here are provided by Violetta Thurstan in her book *The Use of Vegetable Dyes*, eighth revised edition, 1964, and are reproduced here by permission of the author and her publisher, The Dryad Press, Leicester, England.

Gray-Blue for Wool with Logwood

1 lb. wool mordanted with alum and cream of tartar.
½ oz. bichromate of potash.
3 oz. logwood.
1 dessertspoonful chalk if water is very soft.

If chips are used, they should be put in a muslin bag before putting in dye-bath. If logwood extract is used (1 oz. equals ½ lb. chips), it should be thoroughly dissolved with the bichromate and chalk before the wool is entered. The dye-bath should be kept just under the boiling-point for three-quarters of an hour. Then the wool is taken out and washed.

Gray for Wool with Logwood

1 lb. wool, mordanted with ½ oz. bichromate of potash and 1 oz. cream of tartar.
4 oz. logwood.

Method: After the wool has been in the mordant bath for a quarter of an hour, remove it, and add the logwood chips (previously boiled for twenty minutes). Re-enter the wool, and continue simmering for another half-hour.

TROPICAL AMERICA'S ACHIOTE

Capsules of achiote (*Bixa orellana*). The flesh surrounding the seeds provides an important red dye.

Hodge

THE fleshy red pulp that surrounds the seeds of achiote (*Bixa orellana*) provides a red dye that is widely used by native craftsmen in tropical regions around the world. A native tree or shrub in tropical America, it is cultivated in Asia and has run wild in Africa. It goes under various other names—annatto, urucu and roucou among them.

Few other colorings from plants are used in tropical America. However, a pamphlet on Venezuelan dye plants will soon be available from the Instituto Botánico in Caracas.

DYE PLANTS 'ROUND THE WORLD

An introduction to the pages that follow

ON a radio program early in 1964, the young American-born Queen of Sikkim was being queried about the folk arts of her new country. The eagerness with which she spoke of vegetable dyes from native plants stirred our imagination. The plan for "Dye Plants Round the World" was at that moment conceived.

Visions of softly colored Sikkimese fabrics, of Indian silks, Indonesian batiks, Scandinavian handweaving from home-dyed yarns, Scottish tweeds and tartans, and textiles colored with African plants served as a stimulus. Letters were directed to many lands in our search for people who might be able to furnish information about the survival or rediscovery of methods of dyeing by hand with natural products. Realization that we are living in an age of factory-made aniline dyes made our quest especially challenging.

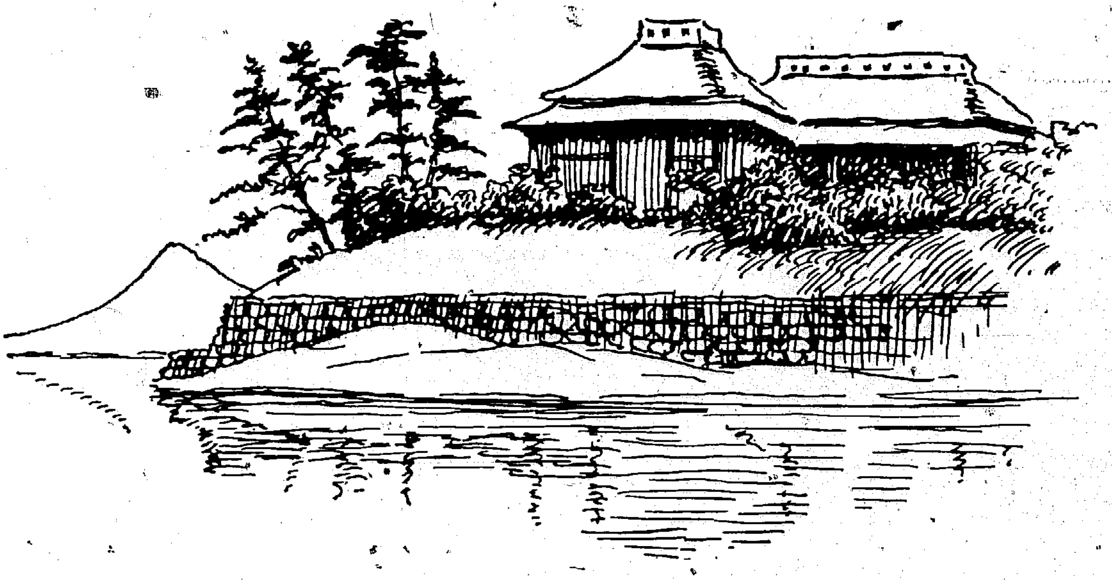
About this time, a small book of dyeing recipes from the Penland School of Handicrafts was sent in by a Botanic Garden Trustee. As a result, I spent a delightful week in the Blue Ridge Mountains of North Carolina, where the Penland School teaches vegetable dyeing, learning from Miss Catherine Morony how to collect, prepare and use the dye plants of the region. This knowledge had been passed down to her by a previous instructor, who in turn was a disciple of the compiler of the original recipes. This brief experience at Penland was invaluable as a background for the coordinating of manuscripts and information for this Handbook.

It seems that there is a newly-awakened interest, particularly among handweavers, in the softer and more subtle color tones achieved with natural materials. Many craftsmen in the United States are now using dyes from plants. The Scandinavian countries are famous for handwoven articles, and, through Botanic Garden friends there, we have been fortunate in obtaining recipes from Norway and Sweden.

Letters to two Japanese friends of the Botanic Garden produced a wealth of information from their country, as well as a monograph in Japanese on a plant-dyeing process that is being revived in Japan. Dr. Tomoya Funahashi, a busy ophthalmologist in Nagoya, spent many evenings translating the monograph into English for our publication of this Handbook. Other correspondents in Scotland, Eire and Northern Ireland have supplied information on the use of vegetable dyes in tweeds. One of these, the Duke of Abercorn, while attending a YMCA meeting, heard of a weaver who spins and dyes the hair of Samoyed dogs with extracts from plants of the English wayside. The Canadian Handicrafts Guild has put us in touch with weavers and dyers in that country. My mother, herself a weaver, was able to supply the name of a fellow craftsman who has experimented with plant dyes in South Africa. And so it has been with our correspondents around the world.

As this is written, I am in Japan with a Botanic Garden colleague. We are on our way around the world, gathering, among other things, still further information on dye plants and ways of using them.

ELIZABETH SCHOLTZ



HOME DYEING A HOBBY IN JAPAN TODAY

REPORTS of the use of dye plants by the primitive Ainu of northern Japan prompted a letter to Kan Yashiroda of Shodo Island in Japan's Inland Sea. Replying on handmade paper colored with a particular kind of dayflower (*Commelina communis hortensis*) grown for the purpose in only one village, Mr. Yashiroda discounted the belief that the Ainus are continuing some of their traditional crafts. "They are too much modern-seekers and too easy going," he remarked. Formerly they used principally the bark of alder and walnut and the wood of yew as dyes.

The fewer than 15,000 Ainu of today are descendants of an aboriginal people who were driven northward many centuries ago by incoming Japanese. Scattered in small villages on the island of Hokkaido, they are protected by the Japanese Government, much as American Indians that remain on reservations are wards of the U.S. Government.

Calling himself and his friends "primitives who hold home crafts in high esteem," Mr. Yashiroda tells here of present-day interest in using dye plants.

Kan Yashiroda

AMONG my own friends, several have been preparing plant dyes themselves and dyeing their own neckties, neckerchiefs, handbags, underwear, and a number of other things. Indeed, a great number of plants in numerous genera are used, according to the color, tones, and shades wanted and the nature of the fabrics dyed.

Sometimes when we are on mountaineering or walking trips I find some are eager to seek plants for dyes, or just to enjoy seeing these very plants growing. A large number of plants used for dyes are native to my home Island of Shodo.

For centuries, in the pre-aniline days, the indigo or anil industry from the cultivated *Polygonum tinctorium* in Tokushima prefecture produced annually a tremendous amount of the indigo-ball to meet the whole of Japan's needs. When I was a schoolboy, there was a dyer near my home. He had in his works ten or more indigo dye-vats, some 3 feet wide and 5 feet deep, filled with distilled indigo, or *ai*. Almost daily I played around the vats with his son, who was my classmate. The dyer was kept busy driving us away from the dangerous vats. A town master's grandson was a worse one!

When I went to Tokushima to see a wisteria bonsai show not long ago, I was told that it is very difficult to find a cultivated specimen of *Polygonum tinctorium*, even in the prefecture where it once was grown commercially. I used to grow it in my garden and used it as a culinary herb, as was often done ages ago.

The commonly used dye plants of olden times, which are still occasionally used, include the following:

Holly (*Ilex pedunculosa*) leaves or bark: reddish brown with alum, brownish black with iron, yellowish brown with lye, reddish brown with lime.

Cryptomeria (*C. japonica*) bark: brownish yellow with lime, bluish black with iron.

Japanese mountain cherry (*Prunus* species) bark: brownish yellow with lime, gray-green-yellow with iron.

Japanese maple (*Acer palmatum*) leaves: brownish yellow with lime, bluish purple with iron.

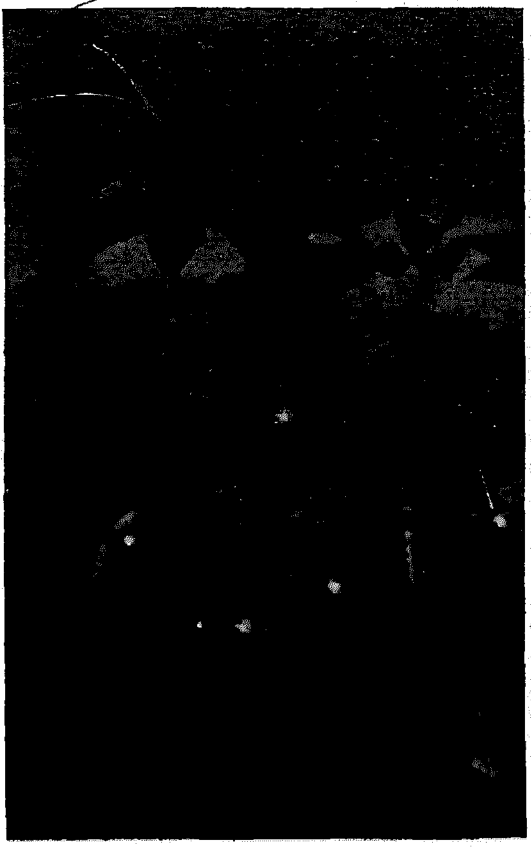
Camellia (*C. japonica*) leaves: brownish yellow with lye, greenish gray with iron. Bark: reddish brown with lime, grayish black with iron. It is only comparatively recently that the leaves have been used.

Ampelopsis (*A. brevipedunculata*) leaves are said to give the best reddish-brown dye with lime as mordant.

Plum (*Prunus mume*) wood: reddish brown with lime, light yellowish brown with lye, light bluish black with iron, blackish brown with lime and iron.

Persimmon (*Diospyros kaki*) juice of astringent fruit: brown without mordant, bluish black with iron. (When I was young I also saw the leaves used for dyeing.)

Gardenia (*G. jasminoides*) juice of fruit: yellow without mordant.



Buhle

Either leaves or bark of this native Japanese holly (*Ilex pedunculosa*) may be used in dyeing. Brownish black, or yellowish to reddish brown comes from the bark, according to the mordant used. In the Kusaki-zome book (see page 44), pale red coloring is said to be produced by the leaves.

Scholar-tree (*Sophora japonica*) flowers: yellow with alum, clear yellow with stannous chloride, yellow tinted with red with copper sulfate, brownish yellow without a mordant.

Sumac (*Rhus chinensis*) bark: pale yellow without a mordant, also with lye; light yellowish brown with lime, brownish black with iron. The leaf-galls are also much valued for dyeing.

Bark of chestnut (*Castanea crenata*), oaks (*Quercus serrata, Q. dentata,* and *Q. acutissima*), sumacs (*Rhus* species) and *Mallotus japonicus* are said to yield very fine black dye with iron, brown without. Bark of *Myrica rubra* yields a valuable dye for fishing-nets: yellow with alum, brown with lime, brownish-yellow without a mordant. ◆

PLANT-DYEING PECULIAR TO JAPAN

Kusaki-zome Brought Up to Date

REVIVAL in Japan of "Kusaki-zome"—or dyeing with natural materials—has been stimulated by the publication in 1961 of a monograph on this primitive art. Knowledge of the method, which reached its full development in Japan in the Asuka and Nara periods (eighth century) might have disappeared had not a movement for its restoration been initiated in 1929.

The book, by Akira Yamazaki (published by Getsumei-Kai, Ltd., in Kakio Kawasaki, Kanagawa, Japan) contains descriptions, illustrations and botanical notes on the plants utilized in natural dyeing; the history of this dyeing process, based on official records and in contemporary literature; and a complete explanation of the process itself. To illustrate the colors obtained, skeins of dyed silk thread have been attached to the pages.

A two-page introduction in English includes a Preface, Plants Used as Dye Sources, and Dye Materials and Dye Processes. There is also an English-Japanese index. The book was published in a limited edition of 1,000 copies. It contains 78 pages. Some of the illustrations are in color.

Fifty plant dye sources are taken up, and these include plants of foreign origin as well as native Japanese species. Among the foreign plants are several from India which have become known around the world for their dyeing properties: sapan (*Caesalpinia sappan*), called suoh; turmeric (*Curcuma longa*)—ukon, and catechu or cutch (*Areca catechu*)—called binroju in Japanese.

The method used for a selected number of the dye plants treated in this book is given in the translation which follows.

The book itself, with Dr. Funahashi's translation, is available for reference in the library at the Brooklyn Botanic Garden.

Akira Kamazaki

Recipes translated by Tomoya Funahashi, M.D.

Bengal Madder (*Rubia cordifolia* var. *mungista*)

The red-yellow roots of this plant are used for dye. They are gathered in late fall and are washed in running water until the yellow juice in them is washed away. They are then dried.

Method of dyeing: First the dried roots are washed in water until they turn reddish. They are then boiled in a pan, but not one made of iron. The cloth is dipped in this extract. For mordanting, ash extract is used. To stain cloth cardinal color, the dyeing must be repeated at least twenty times.

Gromwell (*Lithospermum officinale* var. *erythrorhizon*)

The root is used for dyeing. It should be handled at temperatures lower than 60 degrees Centigrade (140 degrees Fahrenheit); if the temperature is higher the color turns black-violet.

At first, the dried roots are kept in warm water for 24 hours. When they turn soft they are crushed into a muddy juice. This is filtered through linen. The cloth to be dyed is first dipped in ash extract made from *Camellia japonica* or *Symplocos crataegoides* (recently potassium carbonate is also used), then in the extract of the roots. When the dye is well absorbed the cloth is dipped into the ash extract again and held there until it is stained violet. It is then dried in the sunlight. This procedure is repeated 40 to 50 times until real violet color is obtained. Wine-red color is obtained by double staining with *Caesalpinia sappan* and *Lithospermum officinale.*

Sapan or Bukkum-wood (*Caesalpinia sappan*)

This tree does not grow in Japan but trunks of it were imported in Japan from India as early as 900 B.C. The wood of the trunk is used for dye. It is first chopped fine then boiled, but not in a pan made of iron.

A variety of colors can be obtained from this extract by using different mordants. For instance, Botan-iro, ashes of roses, is gained with ash extract; Aka-iro, real red, with alum; and wisteria-violet with iron water.

Iron water is made as follows: rusted iron is thrown in to a mixture of vinegar and water and is well boiled. It is left for one day and night and then the iron is taken out.

Safflower (*Carthamus tinctorius*)

The flowers of this plant are used for dye. They are gathered in June or July, early in the morning, placed in a wooden bucket, covered with water and trampled under bare feet. The yellow juice from the flowers is washed away in running water and then the trampled flowers are covered with matting, moistened with water, and kept moist for three days and nights. When the flowers become mellow they are crumpled between the hands and made into round cakes about 1½ inches in diameter which are dried in the sun. These cakes are called Hanamochi, or flower cakes.

To dye with flower cakes both ash extract and vinegar are needed. Ash from rice straw, wood or lamb's-quarters (*Chenopodium album*) is best, although potassium carbonate may also be used. The ash extract separates the dye from the flower petals; the vinegar is used as the mordant.

The dyeing process: Hanamochi flower cakes are soaked in water for 24 hours, then crushed with the hands to extract the yellow juice, which can be used to dye cloth yellow. When the crushed flower cakes are put into a bucket with ash extract the red flower petals turn red-brown at once, but later turn red again. After they have turned red they are strained through linen or cotton. When vinegar is added, the strained solution turns bright red and is ready for dyeing.

Dyer's Knotweed (*Polygonum tinctorium*)

The plants are cut down before flowering, spread on the ground and dried in the sun. They are then stored in a room—"a room for plants to sleep"—and watered occasionally to induce fermentation. In 80 days *Bacillus indigogenus* turns the plants into a black mass called Sukumo Ai, which is pounded in a mortar into a flat, oval solid known as indigo-ball.

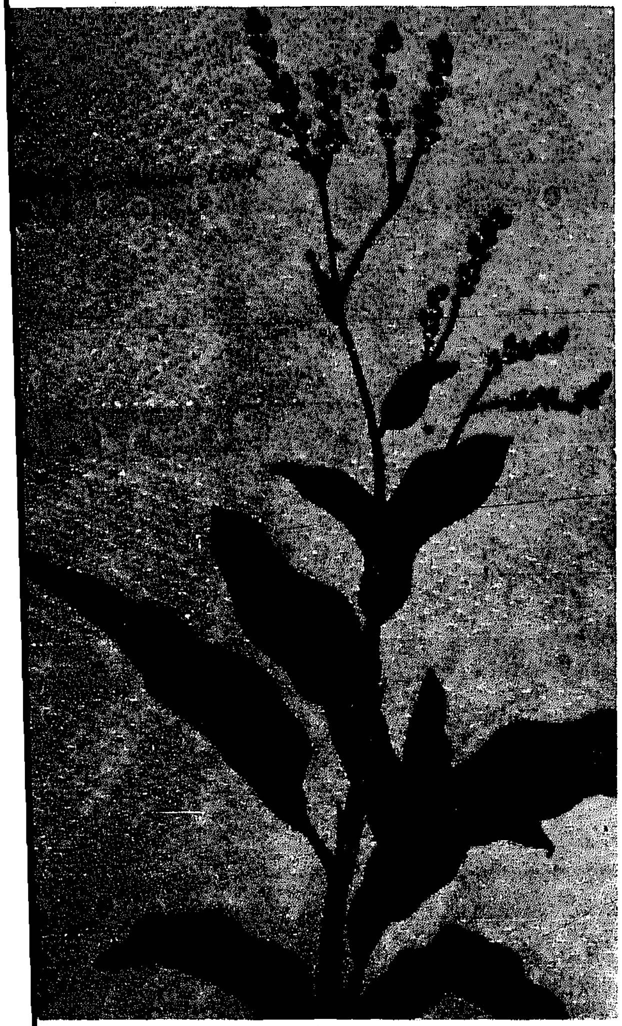
To dye cloth: half of an indigo-ball is chopped and dissolved in alkali water in a large pot. The pot is filled with water to which is added one liter each of lime, bran and soda ash, and 1½ liters of wood ash. The mixture is well stirred and heated up to 20 degrees Centigrade (68 degrees Fahrenheit) with occasional stirring until it foams. In five to ten days the bubbles which have formed on the surface turn blue and the water turns reddish; then one liter each of lime and bran is added. After two or three days 500 cc. of lime and 500 cc. of bran are added to keep the solution alkaline. After two weeks it is available for dyeing. To dye cloth to Kame-nozoki, a very pale blue, merely dipping cloth in the solution is enough; to dye to Asagi-iro, or French blue, two or three dippings are needed; and to dye to Kon-iro, which is navy blue, ten or more dippings are necessary.

Mercury (*Mercurialis leiocarpa*)

Leaves of this plant are pounded in a mortar and put into a large pot which is filled with water and left in the sun five or six days. With alum mordant, this solution will dye cloth blue.

Cape Jasmine (*Gardenia jasminoides* var. *grandiflora*)

Ripe fruits of gardenia, either fresh or dried, are used. Dye is extracted from fresh fruits by squeezing; from dried fruits by boiling. They are mordanted with ash extract or alum. Gardenia and



Scholtz

This painting of the indigo or "ai" plant of Japan (*Polygonum tinctorium*) is the frontispiece of the book on ancient Japanese methods of dyeing with plants (Kusakizome), parts of which are translated here.

alum produce yellow dye; gardenia and indigo, green.

Gallnuts

Gallnuts are swellings on leaves of *Rhus javanica* caused by a parasitic insect. In fall the gallnuts turn yellow-red, as beautiful as coral. Then they are gathered, steamed and dried.

To dye: gallnuts are put in a pan, not an iron one, covered with hot water and boiled. After cloth has been dipped in this solution, it can be mordanted with cold iron water to produce violet gray, or with hot iron water to produce grape gray. (To make iron water, see directions under Sapan, page 42.)

Pomegranate (*Punica granatum*)

Hard skins of the fruit are dried under the sun, chopped and stored. To dye cloth: extract of fruit skins is prepared in boiling water. After cloth is dipped in this solution it may be mordanted with ash extract or with alum for yellow; with iron water for tea brown; and with iron water followed with ash extract for violet blue.

Turmeric (*Curcuma longa*)

Roots of the plant are chopped into a powder, which is dissolved in water, cold or warm. After cloth is dipped into this solution it can be mordanted with ash extract or with citric acid to obtain yellow; with iron water followed with calcium hydroxide for gold brown. For scarlet, cloth is first dyed with *Curcuma longa*, then with *Carthamus tinctorius*.

Walnut (*Juglans sieboldiana*)

The green skin is used for dyeing. It is separated from the hard walnut in a mortar and is dried. It turns black in dried condition.

For dyeing, the dried skins are boiled to obtain their thick extract. When mordanted with iron water, this extract produces violet gray; if lime is used as the mordant, red-purple-black can be obtained.

Japanese Chestnut (*Castanea crenata*)

The extract of the nut-shell, burr and bark of this tree can all be used for staining. When mordanted with iron water, gray color is obtained. When ash extract is added to the iron water, chestnut brown can be expected. The male flower of the chestnut can be used to stain cloth a red-brown color.

Japanese Sumac (*Rhus trichocarpa*)

The red leaves are collected in the fall, dried and kept for later use. To prepare dye, the dried leaves are chopped and boiled (an iron pan should not be used). From the extract, when mordanted with iron water, gray black can be obtained. When cloth is stained with *Polygonum* first and then with *Rhus trichocarpa*, real black can be obtained.

Buhle

The shell, burr and bark of the Japanese chestnut (*Castanea crenata*) are all used for dyeing. Gray is produced with iron water mordant; the color changes to brown when an extract of ashes is added to the mordant.

Longstalk Holly (*Ilex pedunculosa*)

Leaves of this tree are gathered in early winter, pounded and crushed in a mortar, and placed in a pot. Water is added and the pot is left for five or six days in the sun. Cloth is stained with this water and mordanted with alum. Pale red is the color obtained.

Wax-tree, Redlac Sumac (*Rhus succedanea*).

When the extract of the trunk of this tree is mixed with an equal quantity of the extract of *Caesalpinia sappan* and mordanted with vinegar and ash extract, brilliant red-yellow color can be obtained. In olden times this color was used only for emperor's clothes.

Nandina (*Nandina domestica*)

Yellow stems of this plant are cut in the fall, chopped in small pieces and stored. Cloth dipped in the thick extract from these stems and mordanted with iron water will be bluish brown; when lime is the mordant yellowish brown can be expected.

Azalea (*Rhododendron japonicum*)

Leaves of this tree are collected in late fall. Cloth is dipped in the extract made from the leaves, then mordanted with iron water to obtain gray black. When mordanted with lime, red brown is obtained.

Ginkgo (*Ginkgo biloba*)

This tree has two layers of bark. Outside is corky, inside is fleshy. The extract of the inner bark is used to stain cloth whitish brown when mordanted with ash extract or with lime.

Sweet Potato (*Ipomoea batatas* var. *edulis*)

The leaves of the sweet potato are dried under the sun and kept in dried condition. Cloth is dipped in the concentrated extract of the leaves and is mordanted with iron water. The color obtained is a yellowish blue-brown.

Soy Bean (*Glycine soja*)

The extract of black soy beans is prepared in a pan (not an iron pan) in boiling water. Cloth dipped in this extract is stained violet brown. When this cloth is mordanted with iron water the violet brown turns into blue gray, and then into silver gray. ◆

Buhle

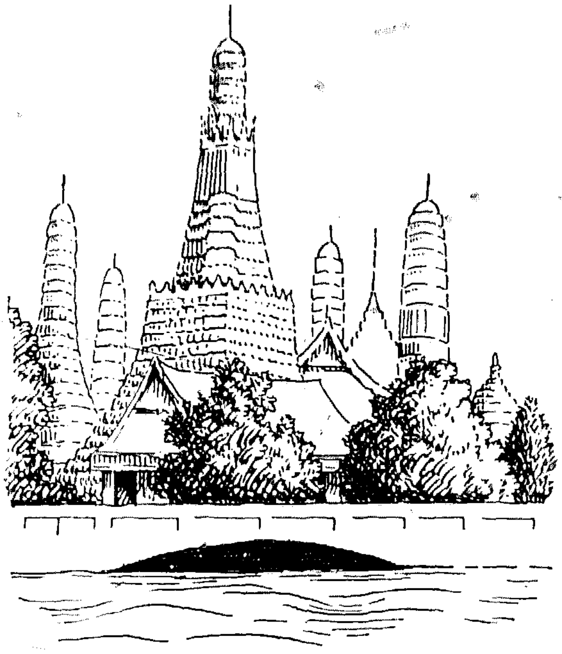
Inner bark of the ginkgo tree (*Ginkgo biloba*) stains cloth a whitish brown, according to Kusaki-zome directions.

THAILAND

BUDDHIST RULES PRESCRIBE DYES FOR MONKS' ROBES

Jack-fruit among many plants used for textile coloring in Thailand

Kasin Suvatabandhu



THE yellow robes of Buddhist monks in Thailand are made and dyed according to regulations set down in the monks' book of discipline. White and all bright colors are prohibited. While the book does not specify the correct color, early religious authority interpreted the instructions to mean that the robe, when made, should be dyed a color in between yellow and red. For that reason, orange and bright yellow being specifically barred, the dull yellow color so often noted on the streets of Bangkok and elsewhere is recognized as the correct tone in Thailand.

Nowadays, however, brighter yellows are often seen, for aniline dyes are replacing the old-time plant dyes. When natural plant dyes are used, heartwood of the jack-fruit tree (*Artocarpus integrifolius*) is the preference. But before the dye is applied, the prepared robe is put in a vat containing a hot or cold water solution made from a decoction of cow dung or red earth or selected plant parts—root, rhizome, bark, wood, flowers or fruits, depending on the requirements. The jack-fruit wood is cut into fragments or slices and boiled in water until the solution is dark brown in color. The wetted robe is then dipped in that solution and held there until the required dirty yellow is obtained. When the robe has dried it is ready to be used under the name of *Kasaya.*

The rhizome of the plant that gives turmeric (*Curcuma longa*) is also used for yellow; likewise the corolla-tube of

Hodge

Jack-fruit (*Artocarpus integrifolius*). The striking yellow robes of Buddhist monks are dyed with heartwood of the jack-fruit tree.

the tree-of-sorrow (*Nyctanthes arbor-tristis*), and the juice of the porcupine orange (*Citrus hystrix*), but the brightness of the color of these has to be held in check by the addition of foreign matter, such as teakwood, coconut fiber, or leaves of *Diospyros mollis*, a kind of persimmon.

These and other plants that are used in Thailand for dyeing include the following:

Black
- *Diospyros ehretioides* (*D. mollis*), a persimmon relative—fruit
- *Elipta alba*—leaves
- *Harrisonia perforata*—fruit
- *Piper methysticum*, kava—root
- *Terminalia bellerica*, myrobalan—fruit

Khaki
- *Artocarpus integrifolius*, jack-fruit—heartwood
- *Curcuma longa*, turmeric—rhizome
- *Oroxylon indicum*, a trumpet-flower tree—bark
- *Tectona grandis*, teak—heartwood

Green
- *Ananas comosus*, pineapple—leaves
- *Garcinia dulcis*, mundu—bark, heartwood
- *Sesbania grandiflora*, a small leguminous tree—leaves
- *Terminalia* species, myrobalan—leaves and bark

Yellow
- *Artocarpus integrifolius*, jack-fruit—heartwood
- *Citrus hystrix*, Kaffir lime or porcupine orange—fruit
- *Cudrania javanensis*, of the Mulberry Family—heartwood
- *Curcuma longa*, turmeric—rhizome
- *Morinda tinctoria* (*M. coreia*), a small tree in the Madder Family—root
- *Nyctanthes arbor-tristis*, night-flowering jasmine, or tree-of-sorrow—corolla-tube
- *Rauwenhoffia siamensis*—bark

Orange
- *Bixa orellana*, roucou, or annatto—seeds and leaves
- *Carthamus tinctorius*, safflower—flower

Red
- *Baccaurea sapida*, rambai—wood
- *Bixa orellana*, roucou, or annatto—seeds
- *Morinda* species—root

FURTHER NOTES ON DYES OF THAILAND

Thao Pheng Sapanikone

WHEN the rhizome of curcuma is used for yellow, it is ground into a coarse powder, mixed with water and filtered. With lime added, the yellow turns to orange. The orange dye from roucou (*Bixa orellana*) is contained in the seeds. When dry, the seeds are dipped in water for only a few minutes to give a dye solution. This is a South American tree that is widely planted in the tropics. In the New World it is known as annatto or achiote.

Two kinds of indigo are used in Thailand, *Indigofera sumatrana* and *I. arrecta*. Leaves of these plants are fermented in water for a night. This juice is then agitated, after which operation indigo is left at the bottom of the container. Water is drained off and the indigo is left to dry. It produces navy blue color, nearly black. The only inconvenience of indigo is that perspiration on it has a very strong smell.

Mordants are apparently not used with vegetable dyes. While table salt is added to the bath made with *Diospyros*, and slaked lime with indigo, it does not appear that these chemicals aid in fixing the dyes into the fibers. Salt acts only as a leveling agent and slaked lime is a developing agent for all vat dyes. For comparison, the Thai Silk Handweaving Factory uses caustic soda with the group of chemical dyes known as indigosols. ◆

SIKKIM AND INDONESIA

SIKKIMESE PLANTS GROWN FOR DYEING

FROM the palace in Gangtok, Sikkim, where the Queen herself—the Maharani or "Denjong Gyalmo"—is interested in native handicrafts, comes a list of plants that are grown locally and used for dyeing in the Palden Thondup Namgyal Institute in Gangtok. The native names have been supplied by the Sikkim Government Orchid Sanctuary and by the Conservator of Forests for the Government of Sikkim.

Ongit Targain

Brown
- Persian or "English" walnut (*Juglans regia*) and black walnut (*J. nigra*), both called "okhar" in the Nepali language

Green
- Zeodary (*Curcuma zeodaria*), leaves of a dye and spice plant similar to turmeric; in Nepali, "keshari"
- *Mahonia napaulensis* leaves
- *Myrsine semiserrata;* in Sikkimese, "sanghe"

Yellow
- Zeodary (*Curcuma zeodaria*) bark; in Nepali, "keshari"
- *Mahonia napaulensis* bark
- Rhubarb (*Rheum nobile*); called "chucha" in Tibetan, "bushing" in Sikkimese
- Sorrel (*Rumex nepalensis*); in Nepali, "halhali"

Orange
- *Mallotus philippinensis;* in Nepali, "sindurey"

Red
- *Rubia cordifolia,* a madder relative; in Nepali called "majhito"
- Yellow raspberry (*Rubus ellipticus*) also called "majhito" in Nepali

In addition to the plants, a lac insect (*Tachardia lacca,* also called *Lucifer lacca*) that lives on various trees, particularly species of *Ficus,* provides red and purple dyes in Sikkim. ✦

INDUSTRIAL TANNINS AND DYES OF INDONESIA

MANGROVE, many species of which grow wild along the coasts, is Indonesia's chief native source of dyes and tannins. All other dye materials produced there come from cultivated plants. Mangrove bark has been exported in large quantities as a tanning agent.

Bark of *Acacia decurrens* has been similarly exported. The tree was introduced from Australia and is extensively cultivated.

Gambier, from *Uncaria gambir,* a Malayan tree, is produced for tanning by boiling twigs and leaves. It is also used for dyeing silk black. The tree is cultivated in Sumatra and West Borneo. [Two thirds of the gambier produced, however, is combined with the leaf of the betel pepper (*Piper betle*) and chewed by most of the populace.]

Divi-divi (*Caesalpinia coriaria*), native in Central America, is cultivated both as an ornamental and an occasional commercial crop. The S-shaped pods are rich in tannin.

Another product originating in tropical America is annatto, from *Bixa orellana.* The shrub was introduced to Indonesia for garden use. Eventually the orange-yellow coloring matter from the seeds became an export for the dairy industry of Holland.

Formerly there was a flourishing indigo industry in Indonesia for export, but this has all but disappeared. Only in middle Java is there now a small production of indigo for the batik industry. ✦

(Adapted from L. van der Veer, "Producten van Indonesië," in *Insulinde,* 1947)

MALAYAN DYE PLANTS

THE tropical peninsula that extends oceanwards some 750 miles off the southeast coast of Asia contains a large number of dye plants, most of them trees. Few, however, are used commercially, except for those connected with the batik industry. The dye plants of Malaya mentioned here are only a sampling of the many that are listed by I. H. Burkill in *A Dictionary of the Economic Products of the Malay Peninsula,* published by Crown Agents for the Colonies, London, 1935.

Black, which in other countries is often difficult to get from native plants, is obtainable from the leaves of a number of Malayan plants. Among them are Chinese tallow-tree (*Sapium sebiferum*), guava (*Psidium guajava*) and persimmon (*Diospyros kaki*), the fruits also used.

There are also several sources of blue: the wood of *Moringa oleifera,* the leaves of *Wrightia tinctoria* (a tree of India and Burma) and the small shrubby (or herbaceous) plants *Strobilanthes cusia* and *Marsdenia tinctoria.* Several other plants are used with indigo: the seeds of *Cassia tora;* the bark of *Ceriops tagal* (a mangrove) to give black, brown or purple; the milk and sap of coconut (*Cocos nucifera*) to produce green; the burned pods of *Parkia* to intensify the blue; and *Terminalia bellerica* as an adulterant of indigo for cheap fabrics.

Red is obtained from the bark of *Columbia serratifolia,* also from several species of *Erythroxylon* and *Eugenia,* the latter giving good color on cotton. The roots of some species of *Morinda,* of the Madder Family, give a red dye, as well as purple and chocolate. Other species yield yellow coloring. The wood of *Peltophorum dasyrachis,* of the Pea Family, dyes red; the bark colors cotton yellowish brown. Dyes from *Morinda* and *Peltophorum* are widely used in the batik industry. The bark and wood of several kinds of *Pterocarpus* give various shades of red on wool and cotton.

Species of *Symplocos* (relatives of the cultivated Asiatic shrub called sweetleaf, *S. paniculata*), have bark which produces a yellow dye and a mordant. With certain other dye plants, it gives red.

An orange-red comes from the wood of *Pterospermum acerifolium,* notably in Thailand, just north of the Malay Peninsula. When clear orange is wanted on silk, fruits of the cucumber-tree or bilimbing (*Averrhoa bilimbi*) are used as an adjunct with other dyes.

Sources of yellow dye, common among the herbaceous plants of the Northern Hemisphere, seem to be less frequently found among woody plants of equatorial regions, as in the Malay Peninsula. Besides some species of *Morinda,* mentioned above, the berries of *Ardisia solanacea* give yellow, as do the leaves of *Xanthophyllum excelsum* and the wood of *Coscinium fenestratum.* Fruits of *Terminalia chebula* give yellow with an alum mordant; with *T. procera,* the bark dyes yellow, the fruits black. Other yellows come from combinations of several plants.

Green is not often produced by one plant alone. The shoots of *Nephelium lappaceum,* a relative of the litchi-nut, will dye silk green if combined with turmeric. (The fruit produces black on silk that has first been dyed red.) A yellowish green is obtained from *Sapium indicum,* a relative of the Chinese tallow-tree.

Yellowish browns come from the leaves of *Tectona grandis,* the wood and bark of *Intsia bakeri,* and the roots of *Ixora longituba. Thespesia populnea* provides a brown dye for wool but not for silk.

Some trees give several colors. The heartwood of *Cudrania javanensis* contains a yellowish-red dye, which becomes orange-green with turmeric and green with indigo. Flowers of *Cedrela toona* of the Mahogany Family can produce dyes of yellow, red or brown.

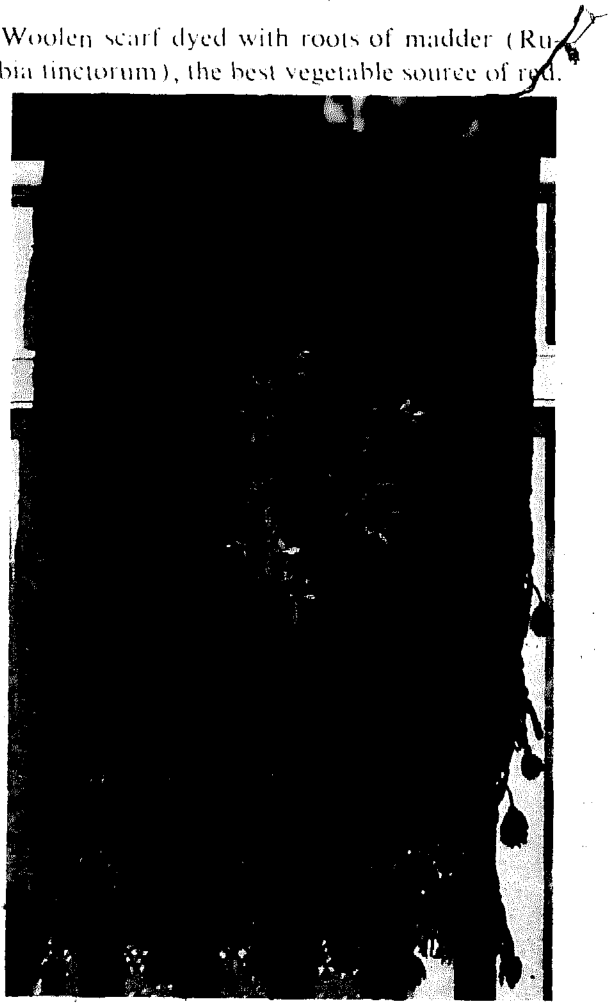
The west coast of the Malay Peninsula is lined with mangrove swamps, and the bark and roots of many mangrove species have served as dyes and mordants. ◆

PERMANENT COLORS FROM PLANT DYES OF ANCIENT USAGE

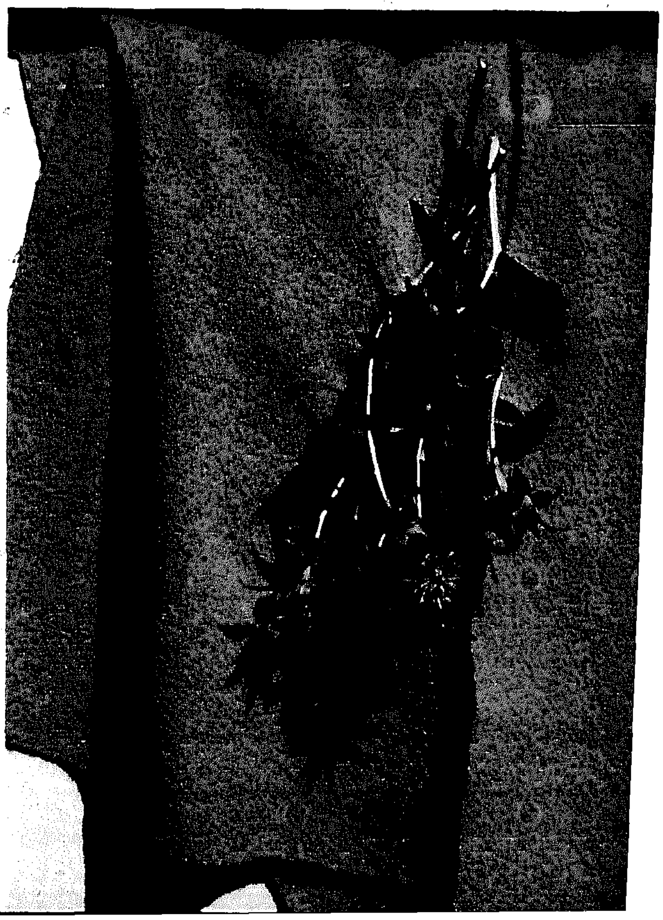
Silk (left), wool (right), dyed with weld (Reseda luteola); a weld plant in flower.

Wool dyed with indigo (Indigofera tinctoria), a dye plant first used forty centuries ago.

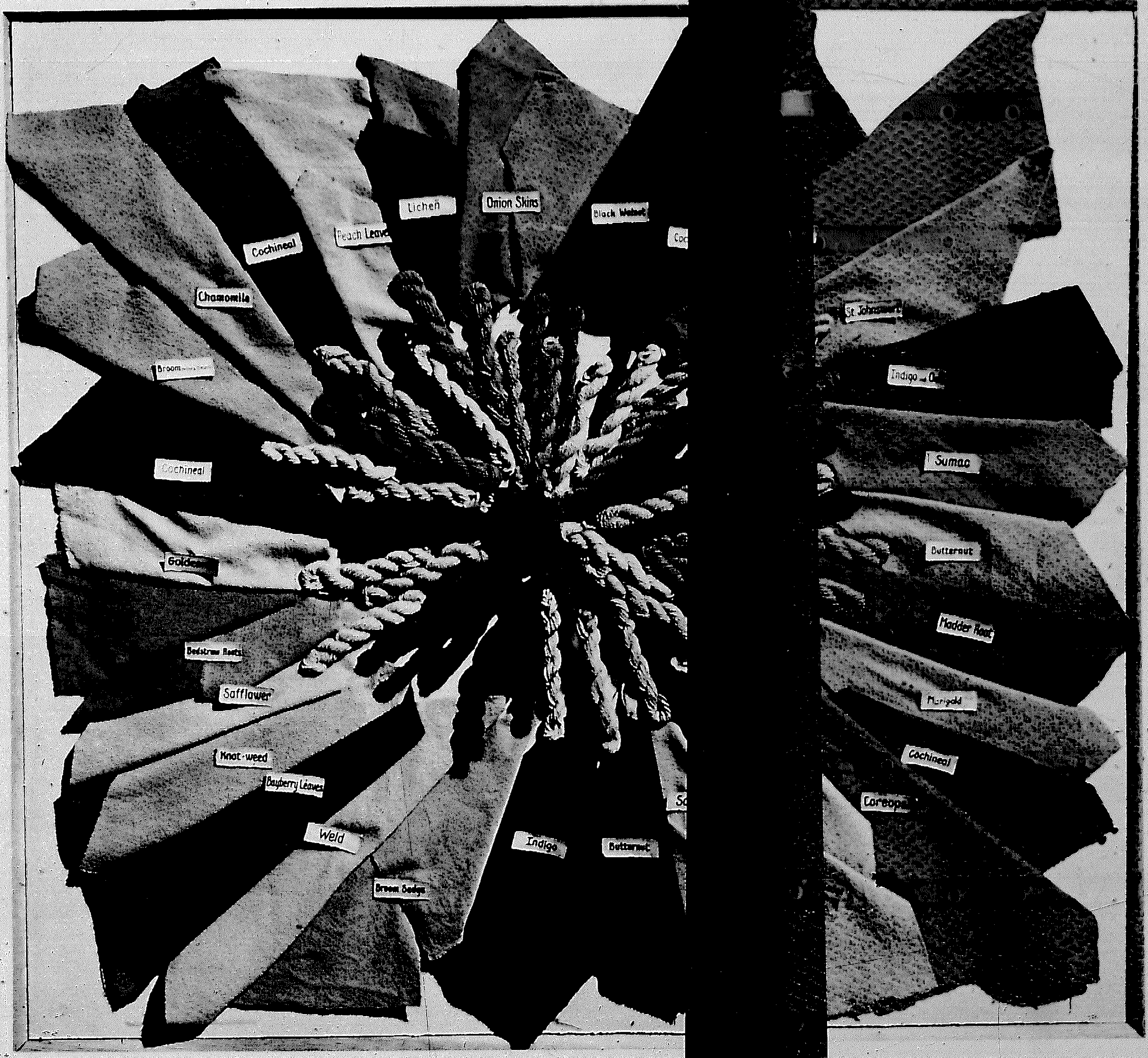
Woolen scarf dyed with roots of madder (Rubia tinctorum), the best vegetable source of red.



Wool dyed with safflower (Carthamus tinctorius). Safflower can also be used on silk.



Fabrics dyed by E. McD. S.



RANGE OF COLORS OBTAINABLE FROM NATURAL DYES ON WOOLEN YARNS AND FABRICS

EXCEPT for cochineal (an insect) plants have supplied all these hues. Madder, indigo, saffron and cochineal dyes are obtainable from commercial supply houses. Some of the plants named here may be gathered from the woods and fields, then dried for later use. Others may be grown in a garden.

Dyed and arranged by E. McD. S.

A CHILD'S EXPERIENCE WITH PLANT DYES

THE YARNS illustrated here were colored in the early 1940's as a special project in the children's program of the Brooklyn Botanic Garden. Colors remain strong after more than three decades. The 14-year-old who did the work achieved varied colors through the use of different plants and mordants.

BROOKLYN BOTANIC GARDEN CHILD'S DYEING PROJECT

5

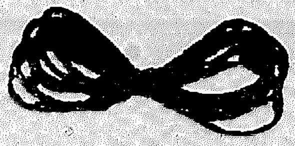
ONION
Alum Mordant

GRAPE AND ONION
Alum Mordant

GRAPE
Alum Mordant

ONION
Chrome Mordant

GRAPE AND ONION
Chrome Mordant



GRAPE
Chrome Mordant

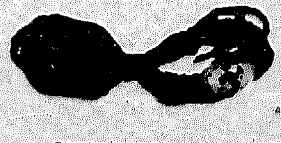
LICHEN

AGERATUM FLOWERS

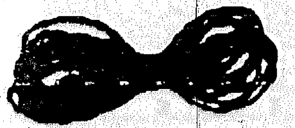
SPANISH MOSS

DAHLIA FLOWERS

PRIVET LEAVES

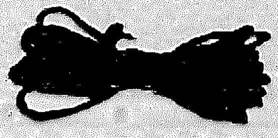


SUMAC BERRIES
Alum Mordant



MADDER
Alum Mordant 2

BUTTERNUT



SUMAC BERRIES
Chrome Mordant

MADDER
Alum Mordant 1

BLACK WALNUT

ZINNIA FLOWERS

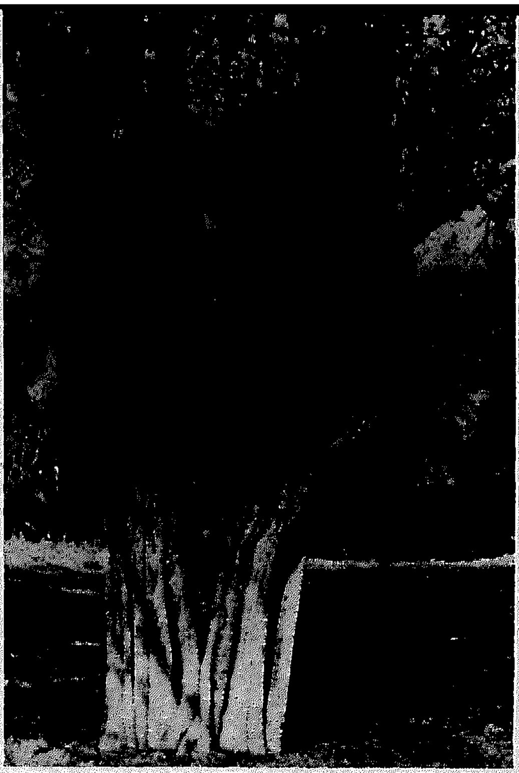
TROPICAL TREES AS DYEWOODS

DYE-producing trees of tropical regions have linked the hemispheres since trade was first begun East and West. Logs of dye-woods from India found their way to Europe over some of the earliest trade routes. As soon as the New World's products became known, they were in demand in Europe, and today are found in many parts of tropical Asia and the islands of the South Pacific. Barwood from Africa, once it crossed the ocean westward, was in steady demand among dyers in the Americas.

Sapan wood (*Caesalpinia sappan*) reached Venice in the 12th century from Sumatra, Ceylon and India. Later, other species of *Caesalpinia* were found to have been so long in use in South America under the name of *brasil* (which became "brazilwood") that they had already given their name to that continent's largest country.

Columbus' discovery of America and Vasco da Gama's sea route to India were decisive events in the development of Europe's dye trade. Later, when wood from tropical trees was imported in great quantity for mills, their influence was felt in America. Most important in the early American dye houses were brazilwood (*Caesalpinia brasiliensis*) for red and purple; logwood (*Haematoxylon campechianum*) for browns and black, also blue, and fustic (*Chlorophora tinctoria*) for yellow.

Under such common names as brazilwood, peachwood, sappan and others, several species of *Caesalpinia*, all with the same coloring matter, were known as "soluble redwoods." The "insoluble redwoods" were of different genera in the *Leguminosae* and were inferior. These included camwood or barwood (*Baphia nitida*), a leguminous tree from west tropical Africa; and red-sanders or red-sandalwood (*Pterocarpus santalinus*) from India. These last were of greatest value in compound shades made with logwood, madder and fustic.



Hodge

The wood of logwood (*Haematoxylon campechianum*) has been used for dyeing in gray, brown, black and blue ever since its discovery in Mexico by Europeans in the 16th century.

Logwood, native of the Bay of Campeche, Mexico, also of Honduras, the West Indies and northern South America, is a hard, heavy wood of deep red color. Its low price and its dependability for brown and black dyes made it valuable, but it never gives a stable blue dye, though widely used on cheap cloth.

Fustic, from *Chlorophora tinctoria*, a tree of the Mulberry Family from the West Indies and South America, is not to be compared with the ancient Venetian fustic from the smoke-tree (*Cotinus coggyria*). Yet the American tree is used commercially today, and an extract from it is available for yellow coloring.

The Osage-orange (*Maclura pomifera*), native to the central United States, therefore not a tropical tree, contains the same coloring matter as fustic in sufficient quantities to have made it commercially valuable as a dye plant.

Two unrelated Asiatic trees, both known as cutch or catechu (*Acacia catechu* and *Areca catechu*), are mentioned on pages 35 and 36 among dye plants of ancient usage. Gambier (*Uncaria gambir*) is also called catechu because of its similar brown dye. ◆

SOUTH AFRICA

MORDANT DETERMINES COLOR

A South African dyer tells how she obtains four colors from one dye

Nine Hellig

WHEN the same dye is used with different mordants, the resulting colors are different but are likely to blend when woven together. Experience has taught me that, while some dyes are more successful with one mordant than another, even if one or two may be uninteresting alone they serve to accentuate the better colors when used in combination.

For every wool bath I prepare, I always test the color on four skeins of wool, each previously mordanted in a different solution. I divide my dye into four equal portions, using four different pots.

In preparing the dye, I generally use one pound of vegetable matter to dye one pound of wool. With logwood, however, the dye is so concentrated that I use less.

The mordants I mix for each pound of wool are these:

tin—½ ounce stannous chloride plus 2 ounces cream of tartar
iron—½ ounce ferrous sulfate plus 1 ounce cream of tartar
chrome—½ ounce dichromate of potash
alum—4 ounces alum (potassium aluminum sulfate) plus 1 ounce cream of tartar

When using iron, I boil the wool in the dye for half an hour, remove it, stir in the ferrous sulfate and cream of tartar, replace the wool and boil gently another half hour. All other mordants are applied in advance in dyeing.

Here are some of the varied results I have achieved with the four mordants:

Figs (*Ficus carica*)—yellow. Fresh young leaves are used. Tin gives the brightest yellow; chrome mordant, dullest.

Rooibos or rooiblaar (*Combretum apiculatum*)—yellow and brown. Freshly chopped living bark is best (dried bark gives duller colors). Iron gives a deep, rich brown; the other mordants rich brownish yellows.

Buhle

Flowers of hibiscus (*H. rosa-sinensis*), with different mordants, give brown, gray, purplish tones, and yellow. If the calyx is left on, the dye becomes rich olive green.

Logwood (*Haematoxylon campechianum*)—yellow, brown, black. Alum gives an insipid yellow, but it blends well with the other colors—near-black from iron, gray brown from tin, and deep rich brown from chrome.

Hibiscus (*Hibiscus rosa-sinensis*)—brown, gray, yellow. Only the flowers are used, either dried or fresh. If calyx and stalk are left on, the color becomes a rich olive green. Tin gives brown; iron, numerous shades from lavender to dark purplish gray; chrome and alum, tones of yellow in a similar range.

Walnut (*Juglans regia*)—brown tones. Dried husks are used. Dark, medium and light brown have been obtained with tin, iron and chrome, respectively. Logwood chips added give a rich, dark brown. ◆

MOROCCAN DYES

M. F. Monnier

IT IS only in small places and in isolated regions that plants are still used for dyeing in Morocco. Yet a few are cultivated for their coloring matter. Along the Draa, a southern river, there are tribes that still are using primitive methods to extract a dark-blue dye from indigo (*Indigofera tinctoria*), which they apparently received long ago from Asia. In Morocco it grows as a biennial herbaceous plant; elsewhere it is generally a shrub.

Safflower (*Carthamus tinctorius*), likewise originally from Asia, is cultivated in that same region, also south of Marrakech, in the west. A poppy-red coloring matter extracted from the flowers is used for dyeing silks and cottons, and for the manufacture of rouge.

Hodge

A famous dye of antiquity is henna (*Lawsonia inermis*), a dry-land shrub of tropical Africa, Australia and parts of Asia. The coloring comes from the leaves which are dried, powdered and made into a paste.

Henna (*Lawsonia inermis*), known and used from earliest times, is both a native and a cultivated plant in Africa. In Morocco it is grown in Doukkla and in several oases of the Souss, near Tunis, and the Draa.

While the madder (*Rubia tinctorum*) of world-wide usage is a Eurasian plant, the other species of *Rubia*, *R. laevis* and *R. peregrina*, are native to Morocco. Cultivation of the natural colonies there provides a small business.

Weld (*Reseda luteola*), whose natural range extends around the Mediterranean, is found wild in the sandy soils along the Moroccan coast. Its use as a yellow dye for wool, however, has virtually disappeared.

Daphne gnidium, an ornamental shrub with small pinkish flowers that are fragrant and long-lasting, abounds along the coast. Its leaves, when boiled, give a greenish-yellow color to wool that has been mordanted with alum.

Orseille (*Roccella tinctoria*), a lichen which is widely distributed and extensively used for dyeing, grows on coastal rocks in southern Morocco. A deep red coloring, used for dyeing carpet wool, is extracted from it there. ◆

OLD-TIME METHODS USED IN TANNING

In the ancient city of Fez today one can see "a tannery courtyard like those in ancient Alexandria, where tanners stand up to their thighs in an evil-smelling mixture of pigeon dung and pomegranate skins," according to June Goodfield, writing in the *Manchester Guardian Weekly*, May 28, 1964. ◆

HOME DYEING IN GREECE

C. G. Macris

In isolated mountainous sections of Greece, such as northwestern Thessaly, western Macedonia, and adjacent Epirus, on the west, dyes are still prepared from plants as they were in the past. Most of the plants grow wild, but some are cultivated.

The classic dyes are still in use: madder, woad, weld and fustic, the last from the smoke-tree (*Cotinus coggygria* or *Rhus cotinus*). Instead of the saffron crocus (*Crocus sativus*) for yellow, the Greeks today use two closely related species, both also fall, flowering: *C. cartwrightianus* and *C. tournefortii*. Such familiar plants as onion, walnut, pomegranate and nettle are sources of dye.

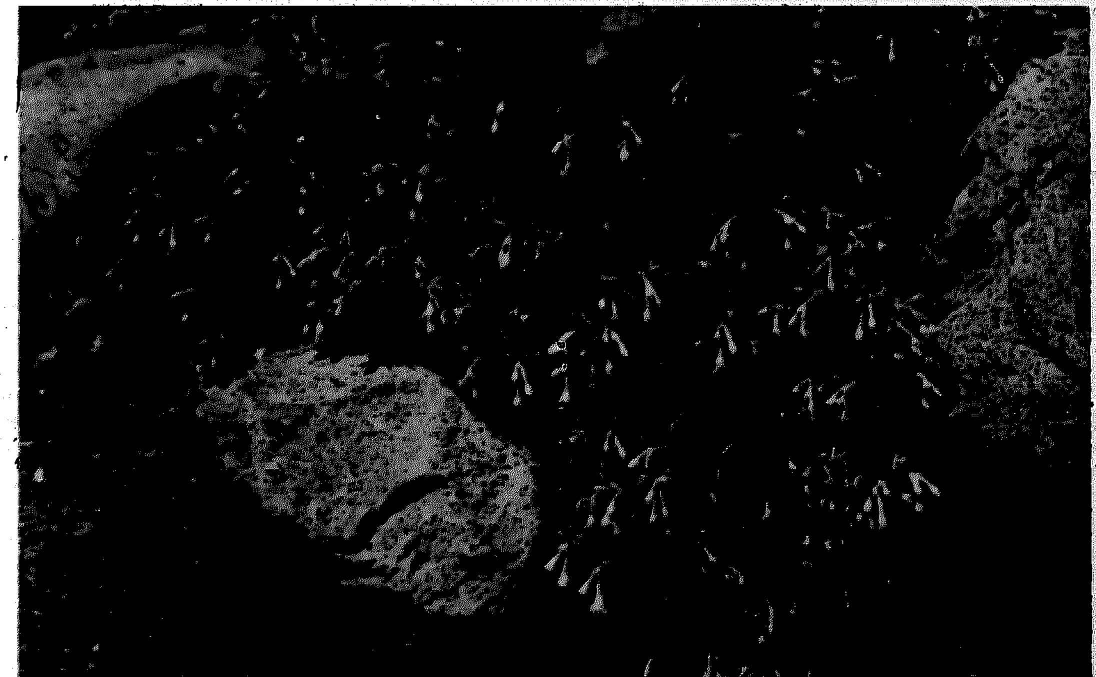
Roots of alkanet (*Alkanna tinctoria*) give red. The Cretan barberry (*Berberis cretica*) provides yellow for both wool and silk. This is the only native barberry in Greece. All parts of the plant, including the root, may be used.

The reddish wood of goat willow (*Salix caprea*), a Greek native, is valued for dyeing. While the flowering ash (*Fraxinus ornus*) may be used in Greece, the bark of *F. excelsior*, a much less common tree found only in the mountains, is known to yield a non-running blue-black color. Dyer's buckthorn (*Rhamnus tinctoria*), which grows sparsely as a shrub, has berry-like fruits that color cloth green or yellow. The dry, winged fruits of black alder (*Alnus glutinosa*) make blue ink; the bark dyes wool and cotton black and is widely used.

A yellow dye is pressed from the flowers of wild calendula (*C. arvensis*). Red is provided by the roots of *Onosma echioides* of the Borage Family and by the whole plant, especially the seeds, of *Peganum harmala*, a rue relative. Two gypsyworts, *Lycopus europaeus* and *L. albus*, aquatic species of the Mint Family, are gathered for the dye pot. An unusual plant used in Greece is the fungus *Polyporus hispidus* (also known as *Boletus velutinus*), which dyes wood and leather chestnut brown. ◆

In southeastern Europe, where the plant is native, roots of *Onosma echioides* are used for dyeing red. In the United States, it is seen occasionally in rock gardens.

Buhle



YUGOSLAVIA

OLD RECIPES, RECENT TESTS

A study of dye plants formerly used in Bosnia and Herzegovina

Hilda Ritter-Studnicka

Buhle

The European flowering ash (*Fraxinus ornus*) has long been an important dye plant. **Bark and leaves** are still used in Mediterranean countries with an iron mordant to give black.

IT has been disappointing to craftsmen that the lovely harmonic colors of vegetable origin are vanishing, being replaced by the synthetic dyes, which give color cheaply without the effort of collecting, cultivating, drying and other preparation. Very few people in Bosnia and Herzegovina nowadays know how to dye with natural products. In investigating dye plants, I have therefore had to rely largely on information gleaned from country people and from 19th century literature, supplementing this by testing some of the early recipes. Certain of the dyes mentioned were used to color paper for Mohammedan books and other religious works in pastel blue, green, pink and so. Alum water was also used for coloring paper.

For testing these recipes of another day, the following method was used: Equal parts (10 to 20 grams) of sheep's wool and dried plant material were boiled one-half hour in one-half to one liter of water. The mordants used were alum and iron sulfate. When iron sulfate is used with plants containing tannin, the result is black.

Some of the old recipes mention winestone (cream of tartar), oxalic acid and tin salts as mordants, but these were used by commercial dyers, as was kermes, the dried female shield-louse (*Kermes ilicis*).

The majority of the plants used by private dyers give a yellow dye. Bark and leaves of wild apple trees (*Malus sylvestris*) yield yellow and orange dyes. The leaves alone give honey yellow. Birch leaves (*Betula pendula*) were much used in olden times for a straw yellow. One kind of yellow dye for paper came from leaves of almond (*Prunus amygdalus*). They were likely also used on yarn. Yellow tones can also be derived from the bark and wood of mulberry (*Morus alba*).

Flowering ash (*Fraxinus ornus*) is well known in Bosnia and Herzegovina and its bark and leaves are still in use here and there as yellow dye material. A long-lasting golden yellow is obtained from the smoke tree (*Cotinus coggygria*, formerly called *Rhus cotinus*). Until quite recently, because of their high content of tannic acid, leaves of this plant were also used in tanning. The hazelnut (*Corylus avellana*) can produce yellow with its leaves and bark, but experimentally it was not satisfactory. Our tests with leaves gave lemon yellow. Tests with elder (*Sambucus nigra*) gave the same result.

In a village near Sarajevo, paper has been colored with elder leaves. With almonds added, clear green was obtained.

Direct green, it was said, could be obtained from coltsfoot (*Tussilago farfara*) and "Cotula fetida" (*Anthemis cotula*). A decoction of coltsfoot certainly resulted in green coloring matter, but our experiments with cotula, even with the addition of ash, resulted only in yellow. There is a record of St.-John's-wort (*Hypericum perforatum*) giving a yellow color, but a dye test yielded for us a beautiful green.

Some recipes mention yellow berries, apparently various species of ***Rhamnus***, the buckthorn.

In the southern parts of our country the well known dyer's broom (*Genista tinctoria*) is represented by *G. ovata*. The similarity between the two plants made us sure that the local *G. ovata* had been used, and our tests with it give a wonderful chrome yellow.

With the exception of *Sambucus nigra*, which was used to color paper blue, no native plant of Bosnia and Herzegovina produces blue. It is even possible that *Sambucus nigra* has been confused with the dwarf elder, *S. ebulus*. In neighboring countries like Montenegro, berries of this are used for making ink.

While henna, from *Lawsonia inermis*, is still used today as in ancient times for coloring hair and nails, garden balsam (*Impatiens balsamina*) is made into a paste and used as hair coloring in some places. The native alkanet (*Alkanna tinctoria*), of the Borage Family, is often confused with henna. Other members of the Boraginaceae represented in our local flora include *Cynoglossum*, *Onosma* and *Lithospermum*. The dye content of their roots is easily detected and is known to have been used in Croatian dye houses.

The main source of red has been madder (*Rubia tinctorum*), which has been cultivated. The similarity of common names leads us to believe that related plants in the Madder Family, as *Galium mollugo*, *G. aparine* and *Asperula tinctoria* were also used.

There is a report that the bark of whitethorn (*Crataegus monogyna*), also forest mint (*Mentha sylvestris*) gave a red color. Research has shown that it was not a mint, but wild marjoram (*Origanum vulgare*) that contains a reddish color. It is still used in dyeing.

Also in current use is the walnut (*Juglans regia*) for browns.

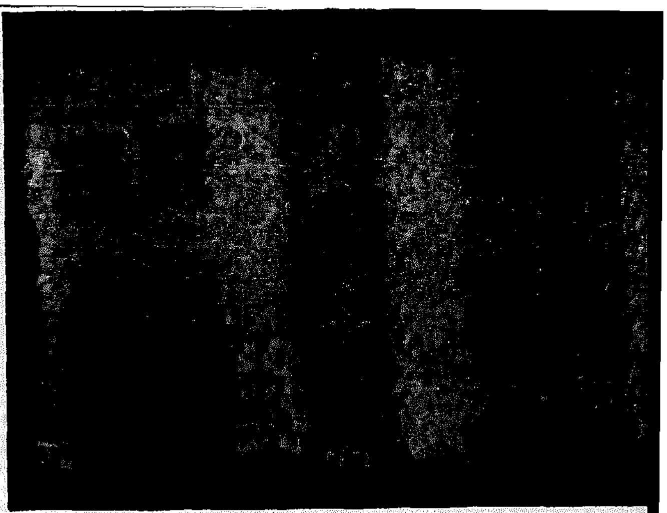
Among other plants once used for dyeing in our area are colchicum (*C. autumnale*), white hellebore (*Veratrum album*), *Serratula tinctoria*, of the Composite Family, and the plum (*Prunus domestica*), the bark of which provided black. Bark and leaves of the flowering ash (*Fraxinus ornus*) and the alder (*Alnus glutinosa*) were also used for black, with iron sulfate or iron filings used exclusively as a mordant. In neighboring countries, bark of blackthorn (*Prunus spinosa*), English oak (*Quercus robur*), and shrub maple (*Acer tataricum*), as well as leaves of barberry (*Berberis vulgaris*) were also used for black.

Some dye plants used in this region were imported even in early days: species of *Caesalpinia* under the names of logwood and "American redwood"; turmeric (*Curcuma longa*); fustic (*Chlorophora tinctoria*), and indigo. It is probable that woad (*Isatis tinctoria*) was also used for blue. A logwood relative (*Haematoxylon brasiletto*) is still used for coloring Easter eggs. ◆

ENGLAND

DYEING YARN SPUN FROM HAIR OF SAMOYED DOGS

Dorothy B. Luke


Scholtz

Hand-spun, natural-dyed Samoyed yarn was used for this hand-woven fabric. Dyes used were English madder (*Rubia peregrina*) for rose-color, indigo (powdered) for blue, dyer's greenweed (*Genista tinctoria*) for yellow, and these last two together for green. The warp is of Shetland wool.

MY specialty lies in the dyeing and weaving of hand-spun yarn from the combings of my home-bred Samoyed dogs. So far as I know, I was the first to attempt this, when wool was rationed during the last war. I do, however, also spin, dye and weave sheep's fleece, and—until recently, while living in Somerset—kept half a dozen Dorset Horn sheep largely for this purpose.

The yarn is spun on a Scottish wheel some 150 years old, or—for demonstration purposes—on a small Shetland wheel which packs easily in a car.

The natural dyes I use are mostly gathered from the hedges and fields of the countryside. Some are, however, from foreign plants such as logwood chips and indigo (which produces a better blue than any other). Cochineal is also purchased.

Generally I first apply a mordant on the well-washed yarn, in order to prepare it to take and hold the color. This is not necessary, however, when dyeing with lichens, walnut hulls or indigo. Of the available mordants, alum is the most usual, being the least expensive, producing the clearest tones, and proving very reliable. Others are bichromate of potash. iron (ferrous sulfate), tin (stannous chloride) and copper sulfate. Skeins of yarn, each treated with a different mordant and then dyed in the same dye bath, are likely to produce different, and sometimes startlingly different, colors.

Home dyes which I have frequently used, with a rough idea of the resulting colors, are these:

Yellows: Dog's mercury (*Mercurialis perennis*)—greenish yellow, becoming almost blue with long boiling; young birch leaves (*Betula pendula*)—daffodil yellow; young bracken (*Pteridium aquilinum*)—almost mustard color; dyer's greenweed (*Genista tinctoria*)—bright yellow.

I also obtain yellow from privet, heath, ling, onion skins and weld.

Tones of red are obtained from birch bark (*Betula pendula*); wild English madder (*Rubia peregrina*)—a very soft rose color; and a bright yellow lichen (found on old roofs) which, when mordanted with chrome, gives a dusty pink.

Plants which dye blue include, besides dog's mercury, elderberries, privet berries, whortleberries and woad.

Larch needles (*Larix decidua*) picked in autumn give brown; walnut husks, (green only)—shades of brown to amber; elderberries (*Sambucus nigra*) with alum give violet; with alum and salt, lilac.

Of the foreign dyestuffs, available in dried or powder form from a good drysalter [druggist], indigo produces quite the best blue and therefore green also (with a yellow), cochineal will give sugar pink, deep red, mauve or purple according to the mordant used and the combination of another dyestuff. Canadian logwood, turmeric, fustic and kermes (the last, like cochineal, being an insect dye which also produces red) are among many others.

I have often found that natural dyes scarcely change in color over many years, even when exposed to sun. ◆

RECIPES FROM EIRE

Lillias Mitchell

Weld, Dyer's Mignonette — **Yellow; old gold; green**

(*Reseda luteola*)

Look for weld in waste sandy places. Gather when it is in flower in June, pulling it up by the roots. Hang up by the roots to dry before using.

Alum mordant for weld:

2 ounces alum to 1 pound wool
¾ ounce cream of tartar

Dissolve alum and cream of tartar in a little boiling water. Add warm water and enter wet washed wool. Raise temperature to boiling point, taking one hour, simmer for one hour. Wash wool in warm water before dyeing.

For old gold: Use chrome instead of alum.

Dyeing method for weld:

4 ounces weld to 1 pound wool

Break up stalks and put them in a muslin bag. Cover them with a little water for the dye bath. Add a pinch of salt to make the color more vivid. Add warm water and enter wetted, washed yarn. Raise temperature to boiling point, taking one-half hour, and simmer for one hour. Take out yarn, shake it, soap wash and hang up to dry.

Weld's yellow color gives a good green with indigo dye

Gorse — **Yellow**

(*Ulex europaeus*)

Gather the flowers in June.

Alum mordant for gorse:

4 ounces alum for 1 pound wool

Dissolve alum in a little warm water. Add more water and put in wool. Bring to boil and simmer for an hour. Rinse well before dyeing.

Dyeing method for gorse: Simmer gorse flowers in a little water for ten minutes. They may be put directly into the dye bath or tied inside a muslin bag. Add more water and put in the wool. Simmer for one hour. Wash with soap, rinse, and dry.

Bracken — **Light green**

(*Pteridium aquilinum*)

Mordant wool with alum.

Simmer young bracken tops for 20 minutes, put in the wool and simmer for 40 minutes.

Onion — **Gold**

(*Allium cepa*)

Mordant wool with alum.

Simmer onion skins for 20 minutes, put in the wool and simmer for 40 minutes.

Broom — **Pale green**

(*Cytisus scoparius*)

Mordant wool with alum, using 2 to 4 ounces, according to the depth of color desired. (More than 4 ounces is likely to make the wool feel sticky.)

Simmer broom flowers for 20 minutes, either loose in the dye bath or in a muslin bag; put in the wool and simmer for 40 minutes. Wash with soap, rinse, and hang to dry.

Crottle (a lichen) — **Brownish red**

(*Parmelia saxatilis*)

Lichens are gathered off rocks during July and August.

4 ounces crottle
⅛ ounce acetic acid
1 pound wool

No mordant is needed.

Fill dye bath with alternate layers of crottle and wool, and fill up bath with warm water, adding ⅛ ounce of acetic acid per pint of water. Simmer slowly for three hours. Lift out wool, shake well and wash in warm water.

By using another lichen, *Parmelia omphalodes*, and following this same method, a deeper color can be obtained.

EIRE

FUCHSIA FLOWERS FOR DYEING TWEEDS

The hardy fuchsia (*F. magellanica*) has spread from gardens to roadsides and walls throughout Eire, as is shown at the right. In a single small shop, The Old Spinning Wheel, at Clifden, Connemara (Galway), on the west coast, fuchsia flowers from these naturalized plants are used for dyeing tweeds. The rose-colored corolla gives one tone of reddish purple, the purple calyx another. The two are often woven together for a richly blended and unusual tweed color combination.

Renshaw

TWO NOTES FROM GALWAY

In Galway, the only plant we use now for dye purposes is a lichen that grows on the rocks near the sea. When used for dyeing tweeds, the cloth comes up the browns of grouse or partridge—admirably suited for shooting jackets.

The man and wife who extract this dye are heading for 80 years; so very shortly their work will be a museum art.

—Pádraic O'Máille

For a method used in the west of Ireland these are the directions followed in Galway:

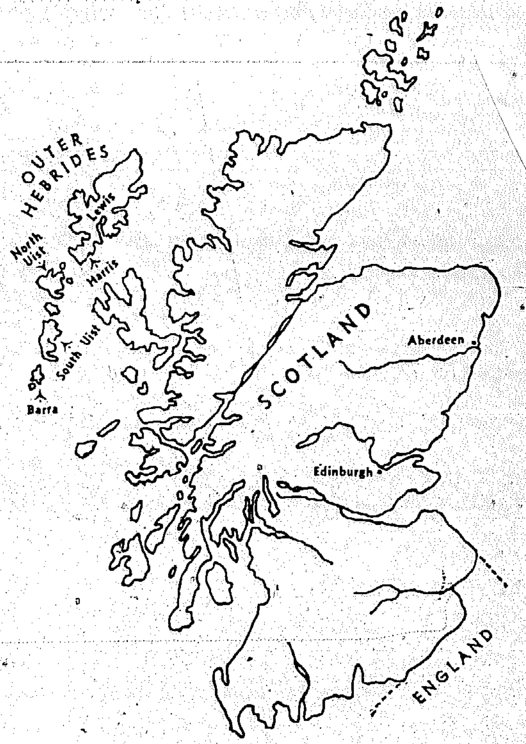
1 pound of lichen to 1 pound of wool

Boil the lichen slowly in water for a few hours. Allow it to cool, then add the wool. The whole is then boiled until the wool has taken on the desired tone of brown.

—Michael E. Mitchell

DYEING WOOL IN THE OUTER HEBRIDES

Winifred A. Shand



IN THE various islands which make up the group known as the Outer Hebrides, off the west coast of Scotland, the woman dyeing wool once had to use vegetable dyes, as they were the only colouring matter available. Her choice was limited to those plants which were indigenous to the area in which she lived. As there are no trees or shrubs, she was confined to using roots and flowers and experimenting with what she could collect. It has occurred to me that the various tartans may have been worked out with a view to what dyes were available in the part of the country owned by that clan. The tartan of Macdonald of Clanranald and Macleod of Harris are mostly green and red with a little yellow, black and blue, while the Macleod of Lewis is mostly yellow with red and black. All these colors are available in the islands and easily gathered in quantity. Blue is the only one not indigenous, so indigo was used, presumably brought from India and Burma by the islands' seafaring men. It was sold in lump form by most of the small merchants in the islands right up to the end of the First World War. When the Germans found out how to make a synthetic blue dye, all the indigo plantations in the East fell out of commercial use, the people of India growing only enough for their own use. Some of the spinners in the Hebrides still have a precious lump of indigo which they guard as if it were gold! Wool dyed with indigo weathers into a lovely shade but does not fade like the synthetic dye, which turns into a dirty gray.

The various plants and roots have to be gathered at different times of the year, and the quality depends greatly upon the weather of the previous season as well as the present one. If there is little sun or if the summer is too dry, the roots will carry much less dye. If the roots are to be used, the dye plants are best gathered before flowering as the dye will then be strong in the roots.

With waterlily (*Nymphaea alba*), used for dyeing black, the "roots"—that is to say the thickened rhizomes—must be gathered in summer when the lochs are shallow, so the dyer can reach them. Having located a rhizome with one's toes, for they are well imbedded in the mud at the bottom, one has to break the sucker roots which hold it down, taking care not to break the rhizome, as it "bleeds," and much of the dye is then lost. This means "guddling" with one hand and arm below the surface, one's face on a level with the water, and feeling one's way, for the silt gets all stirred up. This process disturbs all the midges and clegs (the Scottish horse-fly), which promptly set out to attack the gatherer. One wants to gather the largest possible pieces, but if the summer has been wet, only young rhizomes can be reached, and these produce only a pale gray.

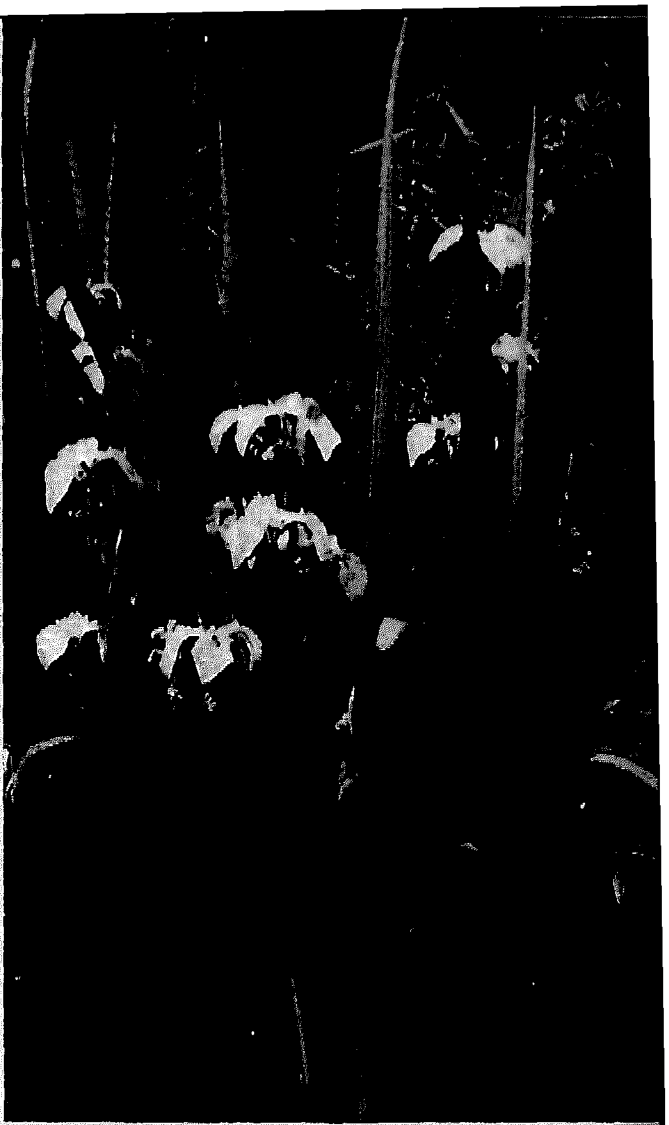
Locality has always counted much, and one islander who still does vegetable dyeing told me that when she lived in South

Uist she found that one sack full of the roots of ladies' bedstraw (*Galium verum*) was sufficient for one dyeing, but when in Barra, less than 25 miles south, she had to collect two sacks to get the same quantity of color. The weavers and spinners in the north end of South Uist used to come right down the 20 odd miles to the south to gather the lichen called "crotal" (*Parmelia saxatilis*), as the rocks there come down almost to sea level and produce crotal with a much richer color.

Black is a dye much used by the island folk for their clothing right up to the present day. Everything, including gloves and stockings, is black for "Sunday best" in Harris and Lewis, and the young women in the area known as "Point" still wear the black head shawl all day, so plenty of black dye was wanted in the olden days. South Uist is the only one of the islands where waterlilies grow in any quantity, but meadowsweet (*Filipendula ulmaria*), iris (*Iris pseudacorus*) and dock (*Rumex crispus*) abound, and the two latter can be gathered and stored.

When dyeing with vegetable dyes was much used, the women were digging up the lady's bedstraw roots in such quantity that sand which the roots held together was being blown away, with consequent soil erosion to the detriment of the "machair" (common grazing ground on the west side of the islands and very fertile). So the women were forbidden to gather the roots, and the penalty for doing so was death. There is no need for that threat nowadays, as few use vegetable dyes.

The dyeing is mostly done out of doors, for it is a messy and tedious business and plenty of water is needed. The best results are obtained when the boiling is done over a peat fire in the open, for this produces a slow, steady heat, and the ash remains hot for hours. I notice that most of the recipes which I have collected and tried out say two hours for boiling the plant parts and half an hour with the wool. Some of the women used to put a potato in the pot with the boiling dye, and when the potato burst the dye was ready.



Roche

Rhizomes of the yellow-flowered **Iris pseudacorus**, found in wet places, give a black dye that is much in demand in the Outer Hebrides.

Nothing is so gentle to the wool as dyes made from plants. One dyer told me that she considered wool a natural growth, and flowers and roots also are natural growth, the two complementary to each other, and I see her point. She is also a firm believer in using urine for fixing and clearing the color of the dyed wool. Some people declare that that is the cause of the famous Harris tweed smell, but the real cause of that is that the wool has been dyed with the black or gray lichen, which, unlike the other medium, remains in the cloth as long as one strand of wool is left!

(*For recipes from the Outer Hebrides, see the next two pages.*)

Recipes from the Outer Hebrides

The Gaelic name used in the islands appears in parentheses immediately after the common name.

Heather (Fraoch) **Various colors**
(*Calluna vulgaris*)

For green, use young heather tips which have not flowered. Boil for two hours, remove heather and boil wool for half an hour with a little alum.

For yellow: Take plants in full flower. Boil plant for one hour, remove and boil wool for half an hour.

For purple: Use only tops of heather. Boil for two hours, remove tops, add 1 ounce alum for every pound of wool, and reboil.

For brown: Use the same method as when in full flower, but gather the plant when flowering is over.

Ladies' Bedstraw (Bun an Ruadh)
(*Galium verum*) **Tartan scarlet**

Dig up whole plants when the flowers are out and leave them spread out for several days to dry indoors. The roots can then be easily picked out and cleaned.

Meanwhile, wash wool in alum and dry it.

After washing the roots thoroughly, chop them very small. Use plenty of roots and put them in a big pot with water. Boil and strain the liquid until it is perfectly clear. Let it cool till it is of hand heat, then put in the wool and boil for at least two hours. Wash wool in salty water for half an hour and rinse in tepid water. Spread out on rocks to dry.

For crimson: Add chrome to the liquid.

For plum-color: Add copperas to the last boiling of the wool, or put in a handful of copper coins.

Rue (An Ruadh Lus) **Red**
(*Ruta graveolens*)

Use the roots, boil for two hours then boil wool in the liquid till the desired color is obtained.

Dandelion (Bearnan Bride) **Magenta**
(*Taraxacum officinale*)

Use whole plant, boil for two hours, remove plant and boil wool for half an hour.

Rickett

Yellow is easily obtained from rhizomes of bracken (*Pteridium aquilinum*) when mordanted with chrome. This fern covers wide areas in the wild in many parts of the world.

Buttercup (Buidheag) **Purple**
(*Ranunculus acris*)

Boil tips of plants with wool till of desired color, then add baking soda.

Sundew (Lus na Fearnaich) **Yellow**
(*Drosera rotundifolia*)

Boil sundew with ammonia. Remove plant and boil wool in liquid for half an hour.

Bracken (Bun Rainich) **Yellow**
(*Pteridium aquilinum*)

Boil roots for two hours. Remove roots and add a little chrome. Boil wool for half an hour.

Ragwort (Buadhalan Buidhe) **Yellow**
(*Senecio jacobaea*)

Boil the whole plant with a little alum, strain liquid and boil the wool in it until the desired color is reached.

Knapweed (Cnapan Dubh) **Yellow**
(*Centaurea nigra*)

Boil whole plant—tops and roots—with a little alum and the wool till of desired color.

Reed or Rush (Cuilc, also Rabhagaich)
(*Juncus*) **Green**

Gather the pinkish flowers of the rush.

chop them and boil slowly for two hours, then allow to cool. Mordant the wool with 4 ounces alum or 1 ounce cream of tartar before placing in the liquid.

Waterlily roots (Bun an Lilidh) **Black**

(*Nymphaea alba*)

Scrape and scrub roots until clean, then beat and pound with a wooden beater till soft. Boil and strain until liquid is clear. Place wool in liquid and boil till a rich brown, then add copperas for final boiling.

Dock roots (Bun na Copaig) **Black**

(*Rumex crispus*)

Wash the roots well, boil for two hours. Add a little chrome and boil wool in liquid for half an hour.

Meadowsweet roots (Lus Cuchulainn) **Black**

(*Filipendula ulmaria*)

Collect roots in July, wash and boil. Strain the liquid till clear, then boil the wool in it till the color required is obtained.

Meadowsweet stalks and leaves (Lus Cuchulainn) **Blue**

(*Filipendula ulmaria*)

Boil stalks and leaves together for two hours. Strain, then boil wool in liquid till navy blue is obtained. Boil with roots of sorrel (*Rumex acetosa*) to fix the color.

Lump Indigo **Blue**

Old recipe from Outer Hebrides

Boil wool with onion skins till clear yellow, then let wool dry. Have an old pail filled with urine at least two weeks old, or until skin forms on top. Use wooden tub for dyeing. Put lump indigo in a muslin bag, heat the "bree" to hand warmth by placing a hot stone in it. Squeeze in the blue bag. Wet the wool and place in the liquid. Cover the wooden vessel and place where it will keep warm. After 24 hours take the wool out and *shake* it, do not wring or squeeze. Heat the stone again in the fire and place in bree till hand heat again; replace wool and cover as before. Repeat shaking and reheating every 24 hours for at least seven days. For navy blue, 11 to 21 days are required. Fix with boiled sorrel roots as rinsing water, but do not boil the bree as it loses its properties.

Other dye plants and their colors used in the Outer Hebrides include the following, the Gaelic names appearing after the italicized botanical names:

Green: Buds of bracken (*Pteridium aquilinum*)—Bun Rainich

Yellow: Bog-myrtle (*Myrica gale*)—Roid; St.-John's-wort (*Hypericum perforatum*); teasel (*Dipsacus fullonum*)—Lus an Fhucadair; monk's rhubarb (*Rumex alpinus*)—Lus na Purgaid

Orange: Bramble (*Rubus*)—Smeuran

Brown: Walnut (*Juglans regia*)—Geinn

Brown, purple or blue: Blaeberry or whortleberry (*Vaccinium myrtillus*)—Lus an Deare

Black: Oak (*Quercus robur*)—Darach, use bark and acorns; alder (*Alnus glutinosa*)—Fearna, mordanted with copperas

Black or deep fawn: Iris (*Iris pseudacorus*)—Bun Sealasdair

Lichens Used in Dyeing Wool

The lichen known as crotal, or crottle (*Parmelia saxatilis*) grows on rocks. Gather it on a windless day when it is wet, preferably in March or November. It will keep indefinitely when dry.

For orange: Wet the wool. Line a vessel with black lichen, then "ply" in layers of wool and lichen, topping it off with lichen. This is a "contact" dye and the dye is infused into the wool. Fill the pot with water till lichen at top is covered. Boil, on a peat fire if possible, as it gives a slow steady heat, until required depth of color is seen on wool under top layer of lichen. Remove pot from fire and stand it outside for 24 hours to cool. Drain off the water and shake the wool so that the wet lichen drops out, and lay it out on rocks to dry.

For deep "Highland cattle" brown: Follow the same method, using gray lichen gathered from the hills.

For rosy pink: Use yellow lichen (*Xanthora parietina*) which grows just above the high tide mark on rocks. ◆

USING PLANTS FOR DYES IN NORWAY

Sophie Sverdrup

Translated by Inger Tormundsen

PEOPLE desire to be handsome, have handsome clothes and have beauty around them. Colors have a lot to do with beauty. The spinning materials we get from plants do not have much color, only gray and dull yellow. Some of those from animals are nice shades of black, brown, gray and blue gray, but most wool is white. Dyes from plants were long used for brightening these materials, but after about 1850, when synthetic colors were adopted, the use of vegetable dyes was reduced until it was almost entirely forgotten.

Plant coloring, however, is still important. The chemical industry makes all kinds of soft, fine colors and states that these have better fastness than the dyes from plants, which are criticized for fading. (One can test colors by hanging yarn in a window for a few months.) But the dyes from plants have the advantage of fading only a little at a time, if at all; they do not turn into different colors.

Methods of dyeing vary. Solution dyeing is probably the oldest method. In this, the plant parts go through a fermentation process and the material to be colored lies in the dye solution (which is kept lukewarm) for a long or short period of time. More often, the plant parts are boiled, and the material is boiled in the resulting color bath. To get most colors one uses a mordant, which is a link between the color and the material. This is often alum, tartar, iron vitriol (copperas), copper vitriol, or something similar. Blood and urine have been much used in dyeing.

The boiling kettle has influence over the color. Copper kettles are best; iron kettles are good for some colors. For example, if heather is boiled in a copper kettle, a beautiful deep yellow color will result. If an iron kettle is used, the color will be greenish.

Different textile materials absorb colors differently. Fibers from animals, as wool, hair and silk, absorb color much more easily than fibers from plants—flax, hemp and so on.

Colors from Flowering Plants

Red

Bedstraw (hvitmaure: *Galium boreale*), which grows along the roads and in uncultivated fields, has been used since olden days. Its roots give a yellow-red color, soft and very beautiful. It blooms in July, is 30 to 50 centimeters (12 to 20 inches) high, and has small white flowers with a sweet, luscious scent. The roots are branched and are as thick as a knitting needle. When the bark is scraped away, they are reddish yellow. Roots should be collected in spring before flowering starts or in fall when they have been supplied with nutrition. After they are cleaned of earth they are dried. Before being used they are ground or finely cut.

The lichen *Ochrolechia tartaria* also gives a red dye (see page 68).

Blue

We have no native wild-growing plants that give blue color, but woad (*Isatis tinctoria*) has been cultivated in Norway, and it now grows wild in some places.

Yellow

We can get yellow from so many leaves and plants that we could dye all the wool in Norway yellow, if we wished to. The leaves of birch, willow, alder and aspen give different yellow and yellow-green colors, used either fresh or dried. They have the most strength of color when

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Translated and condensed from a chapter on dye plants by Sophie Sverdrup in *Nyttevekst Boka*, published in 1942.

Buhle

Leaves of tansy (*Tanacetum vulgare*), if plucked from the plant before the yellow button-like heads of flowers appear, will give cloth or yarn a clear yellow-green color.

fully grown, about St. John's Day (June 24) or a little later. They can be used for drying as long as they are green. They should be picked in good weather, laid out in the shade in thin layers, and stirred a little every morning and evening. Everything, in fact, which is to be dried for coloring, should be kept in the shade. When the leaves are thoroughly dry, they may be stored in paper bags in a dry place.

Heather (røsling: *Calluna vulgaris*) is common over the whole country on heaths, marshes and knolls. It gives yellow and bronze-brown colors. By adding iron, the color will turn blue-green; if blue is also added, it becomes deep green. Heather can be used the whole year round. For drying it is preferable to take it when it starts blooming. Either the whole bush or the young branches and twigs may be used. It dries easily.

Sweet gale (pors *or* post: *Myrica gale*) is a small bush which is easy to recognize because of its good scent. It grows in marshes and near forest lakes. It is best to collect the young branches for drying when the leaves are grown. The branches can also be gathered and used in winter. This plant gives a fine yellow color, which, like many other yellows, can be changed by adding other dye materials.

Coltsfoot (lersol: *Tussilago farfara*) blooms early in the spring. The leaves give a green-yellow color which turns into a beautiful green if copperas is added.

Lady's-mantle (marikåpe: *Alchemilla vulgaris*) bears its small modest flowers from May until frost comes. All the green on the plant can be used for coloring.

Sorrel (syre: *Rumex acetosa*) gives a greenish-yellow color. The leaves of this and other kinds of sorrel can be used the whole summer, but they are best in spring.

Chervil (hundekjeks: *Anthriscus silvestris*) grows about the whole country. Its foliage gives a clear yellow-green color.

Bearberry (melbaer: *Arctostaphylos uva-ursi*) is very similar to cranberry, both in foliage and fruit, and the leaves keep green over winter. The whole plant, except for the root, can be used all year, but it should be picked before the berries form. It gives a cloudy yellow-green color, which turns into a handsome gray when more dye is added.

Beggar-ticks (brønnsle: *Bidens tripartita*) can be found in damp places, but the plant is little known. It can be used from June until August, before or after it blooms, and either fresh or dried. It gives a strong yellow color.

Barberry (berberis: *Berberis vulgaris*), which is cultivated over the whole country, has begun to grow wild in the southern parts. For a soft red-yellow color, small twigs bearing young leaves are cut and used either fresh or dried.

Tansy (reinfann: *Tanacetum vulgare*), both cultivated and wild, grows in dry places and gives off a strong spicy smell. Before the plant blooms, the leaves can be used to give a fine, clear yellow-green color.

Dyes from Nonflowering Green Plants

Horsetail (skogsnelde: *Equisetum sylvaticum*) and other kinds of scouringrushes give beautiful grayish-yellow colors. The segmented stems with their sprays of green branches are easily picked in July and August when they are fully developed. They are easy to dry, or they can be used immediately.

Hairy-cap moss (bjønnemose: *Polytrichum*) is used on Alands Island for a grayish-yellow coloring.

Clubmosses (kråkefot *or* jamne: *Lycopodium*) of several kinds grow as trailing evergreen plants, mostly in the forests. For drying, they should be collected in the spring, but they can be used fresh all year round. They give a grayish-yellow color, but they are used mostly as a base for other colors.

Juniper (ener: *Juniperus communis*) has blue berries which provide a brown dye. The wood, bark, and even the yellow lichen which grows on junipers are also usable in dyeing.

Tree Barks Used as Dyes

Tree bark should be collected in the spring when the sap is in the trees, and it should be taken from young trees which are not overgrown by moss. Yet the branches should not be too thin. The bark is dried, and can then be kept in bags for several years in a dry place. Almost all bark contains tannic acid, so when iron salts are added, dark colors are obtained.

Some of the trees whose bark is especially valuable for dyes are: ash (ask: *Fraxinus excelsior*) for green and brown, the wood also being usable; birch (bjørk: *Betula pendula*), a durable gray; apple (epletre: *Malus pumila*), strong yellow; English oak (eik: *Quercus robur*), gray and black; bird cherry (hegg: *Prunus padus*), gray; willow (isterpil: *Salix pentandra*), brown; alder (or: *Alnus incana* and *A. glutinosa*), yellow, yellowish brown, and brownish gray, also black; rowan-tree (rogn: *Sorbus aucuparia*), gray; blackthorn (slapetorn: *Prunus spinosa*), reddish brown; buckthorn (trollhegg: *Rhamnus frangula*) bronze brown after drying for a year.

Scholtz

Bark of several species of *Prunus* is counted among the natural dyes of northwestern Europe. Pictured here is dried bark of an American cherry (*Prunus serotina*) as prepared for dyeing at Penland School of Handicrafts.

Lichens as Coloring Agents

Almost all kinds of lichen can be used for coloring. They can go directly on wool without a mordant, but some have to go through a process of fermentation before they will release their color. Many fine, subdued tones can be obtained from them. Most important is the gray stone-lichen (gra steinlav: *Parmelia saxatilis*), which gives a slightly reddish brown color, especially beautiful for backgrounds. The brown lichen (brunlav: *Parmelia omphalodes*) gives a clean dark brown; the green one (grønn steinlav: *P. conspersa* or *P. centrifuga*), about the same as *P. saxatilis*, but it is less common. These lichens grow on stones, sometimes along the coast, sometimes in the mountains.

The gray beard lichen (trådlav: *Usnea barbata*) and the black beard lichen (svartlav: *Bryopogon jubatum*), both give greenish yellow, as does hair-moss (hårlav: *Alectoria sarmentosa*). Reindeer-mosses (reinmose *or* reinlav: *Cetraria* or *Cladonia*) of several kinds give yellow to brown. The papery lichen (papirlav: *Cetraria glauca*) grows as big thin slices that look like leaves; Iceland-moss (Islandsk lav: *C. islandica*) branches and grows about four inches high.

The white stone-lichen called "korkje" (*Ochrolechia tartaria*), which is common on rocks and tree trunks, gives red or pink when fermented in urine. It was formerly an export item. ✦

NORWAY

SEVERAL COLOR TONES FROM ONE DYE BATH

Dagmar Lunde

Sweet Gale — **Yellow**
(*Myrica gale*) — (three shades)

Three different tones of yellow can be obtained from the same dye bath of sweet gale leaves. The wool is divided and all three skeins are at first dyed together. Two of the skeins then receive additional treatment separately. Here are the directions:

For 300 grams (12 ounces) of worsted divided into three skeins, use:

40 grams (1.6 ounces) of alum for mordanting
250 grams (10 ounces) of sweet gale leaves

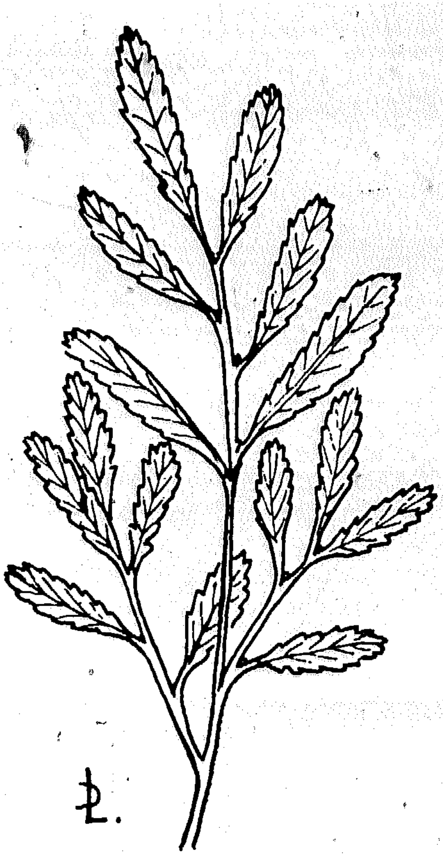
Mordanting

Put the clean wool in lukewarm water in an aluminum kettle for two or three hours. Stir the alum in warm water until dissolved. Add enough water for a mordanting bath and heat slowly. When temperature reaches 40 degrees C. (104 degrees F.), put the wet wool in the kettle and simmer for one hour. Let cool in the kettle.

Dyeing

1. Cover fresh leaves with cold water and let boil for one hour. (If dried leaves, soak for a night beforehand.) Strain and return the ooze to the same kettle. Add enough water for a dye bath and heat slowly. When temperature reaches 35 degrees C. (95 degrees F.) drop the worsted in the dye bath and let simmer for 45 minutes. Remove the skeins from the dye bath and hang up. They will be a golden yellow.

2. Pour half of the yellow dye bath into a kettle and add 5 grams (.2 ounce) of copper vitriol. Stir until it is thoroughly dissolved. Add water. With temperature at 40 degrees C. (104 degrees F.) drop one skein of yellow yarn in the kettle and let it simmer for 15 minutes. Remove the wool and immediately hang up. The color will have changed to a warm yellow brown.



Sweet gale (*Myrica gale*) is favored for the several tones of yellow it can produce. Only the leaves are used.

3. Pour the other half of the yellow dye bath into a kettle and add 5 grams (.2 ounce) of iron vitriol. Stir until it is thoroughly dissolved. Add water. At 40 degrees C. (104 degrees F.) drop the remaining skein of yellow yarn into the kettle and let simmer for 15 minutes. Remove the wool immediately and hang up. The result will be a cold yellow green.

When all three colors are finished the wool must be washed and rinsed. Hang to dry in a shady place. The three tones can be beautifully blended. ✦

RECIPES FROM LAPPLAND

Lisa Johansson

Translated by Kerstin Gustafsson

Spruce **Camelhair-color**
(*Picea abies*) *For wool or cotton*

Cut twigs from spruce (without lichens), chop them and let them simmer for 12 hours. Use an aluminum or enamel kettle. Add the yarn on top, but keep it submerged in the bath. Hold the temperature at 80 degrees C. (176 degrees F.). Stir to get an even color. When the desired shade is obtained, hang the wool to dry without rinsing. You can get different shades according to the time the yarn is in the dye bath.

Bearberry **Green**
(*Arctostaphylos uva-ursi*)

Use the fresh plants, rinse them and boil four hours. Add alum and leave the kettle on slow heat. Strain and add iron vitriol. Test the color; if right, add the yarn and leave it in the bath for at least one hour. Stir carefully. Rinse and hang it up to dry. If you add blue vitriol (copper sulfate) you get a blue-green color.

Onion peel **Yellow; green; moss green**
(*Allium cepa*)

Several strong and beautiful colors can be obtained from onion peel. You must experiment with the measures and weights.

For yellow: Use an alum mordant. Simmer the onion peel in water. Put wetted material into the dye bath and continue simmering until you have the right color.

For green: Follow the directions for yellow, but use ferrous sulfate and copper sulfate as the mordant.

For moss green: Follow directions for yellow, but add iron sulfate to the alum mordant.

Mountain-cranberry **Red, yellow**
(*Vaccinium vitis-idaea*)
For wool, linen and cotton

Use stems with leaves of this plant (which is known to us as lingonberry) gathered in summer. Boil two hours, add alum. Now add the yarn, stir and keep it in the bath for one hour or until desired shade is obtained. Rinse and hang it to dry.

Dock **Light grayish-pink**
(*Rumex acetosella*)

Use whole plant; place in large wooden bowl, add water and alum, and leave this to steep two to three weeks. Add yarn, stir to get even color. Leave in bath for a couple of days. Hang to dry without rinsing.

This method can also be followed with birch bark, willow, mountain-ash (*Sorbus aucuparia*), alder, fresh birch twigs (for yellow green), and yarrow (*Achillea millefolium*).

Birch **Yellowish green**
(*Betula nana*)

Cut twigs from birch and chop them into small pieces. Add water and alum and boil until the water is yellowish-green. Add gray yarn, which gives the best result. Let it simmer until the yarn has a yellow-green color.

Juniper **Oxblood brown**
(*Juniperus communis*)

Boil twigs of juniper until you get a dark liquid. Strain and add alum and tartar and baked red beets, cut into pieces. Add the yarn and stir to get an ecru color. Let stand for two days, then heat and stir for at least one hour. If the color is too light add a little copper sulfate (blue vitriol).

Horsetail **Yellow, greens**
(*Equisetum arvense*)

Yellow is obtained with an alum mordant and very little boiling.

Iron vitriol (ferrous sulfate) gives gray green, and copper sulfate gives grass green.

If the kettle is aluminum or zinc it gives a green color after two hours with or without boiling. ✦

ABORIGINAL DYES IN CANADA

Douglas Leechman

THE Indians of the British Columbia coast practiced the art of dyeing, particularly in the manufacture of the elaborate Chilkat blankets. The dyes used for this purpose were hemlock bark, which was boiled in urine or with a black mud, to provide a black; a lichen, commonly known as wolf-moss (*Evernia vulpina*), for yellow; and copper ores, boiled in urine, which gave a greenish blue. Alder bark, a dye which is used wherever this tree occurs in Canada, provided another shade of yellow or orange and was much favored on the West Coast for dyeing twilled mats and ceremonial neck-bands and crowns of cedar bark. Water-tight boxes and, further inland, coiled baskets served as dye-pots.

Turning now to the East of Canada, we find that the forest-dwelling people, in the Great Lakes region, had made much progress in the art of dyeing. Here again special factors favored the development of the craft. Being pre-eminently a forest folk they had acquired a thorough knowledge of the local flora. They made very general use of herbal remedies and had discovered the virtues, real or imaginary, of many plants, some of which are quite inconspicuous in habit. The large number of dye-plants included in their pharmacopoeia almost suggests that deliberate research in the technology of dyeing is not too bold a claim for them.

The greatest weakness in their technique is found in their limited use of mordants. The acid juices of crab-apples and other wild fruits served this purpose, but it was not until the coming of the white settlers that the Indians learned to use a copper vessel as a dye-pot and to add alum or copperas to their dyes to fix the color.

Among the more important dyes used for various colors may be mentioned alder, bloodroot, bedstraw, lamb's-quarters, pokeweed, puccoon and sumac, all of which yielded a red dye; goldseal and goldthread for yellow; walnut for black; bittersweet for a bright orange; ash and yellow adder's-tongue for green; wild grape and larkspur for blue. Simple boiling of the goods to be dyed in a decoction of the dye-plant was the usual method employed. After boiling, the bath was allowed to cool and the dyer then rinsed the goods in water to remove unfixed dyes. If necessary a second dyeing, at times in a different color, was resorted to. Many of the colors were fugitive, but others retained their brilliance for years. ✦

Roche

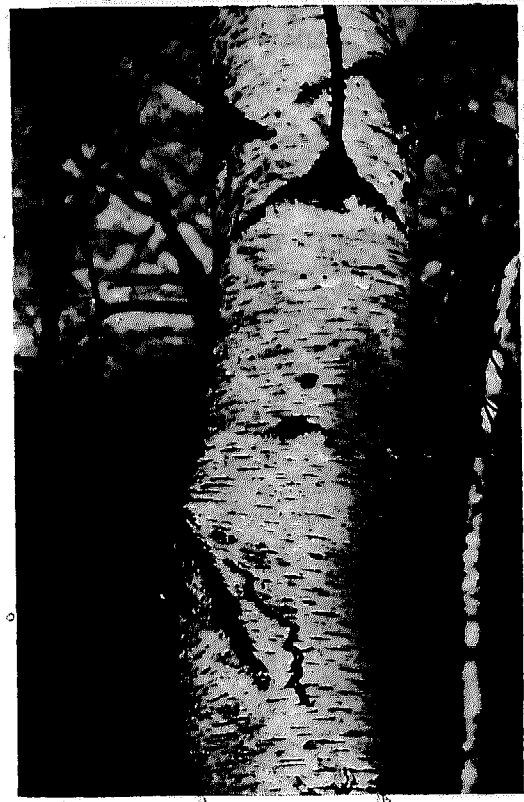
The handsome black berries of pokeweed (*Phytolacca americana*) were an important source of red dye for the aboriginal Indians of Canada.

(From an article on "Aboriginal Paints and Dyes in Canada" published by the Royal Society of Canada in its Transactions for 1932)

WESTERN CANADIAN RECIPES

From the prairie region

Grace Raitt



Rickett

Inner bark of white birch (*Betula papyrifera*) makes a light brown dye; it becomes green when copper sulfate is added.

WOOL must be washed first with good soap, well rinsed and entered in the dye bath while still wet. While simmering, keep lifting and stirring wool with a flat stick. I use an old copper boiler or a heavy aluminum pot for all my dyeing.

[Note that these recipes are for one-half pound of wool.—Ed.]

Lichen **Yellow; light green**
(*Parmelia manshurica*)

For yellow:

½ pound dry lichen
½ pound wool

A mordant is not needed.

Crush dry lichen into tiny bits, put in muslin bag, soak overnight in soft water. Boil for one hour. Enter washed and rinsed wool while still wet. Simmer for one hour. Rinse thoroughly and dry.

For green: A copper sulfate mordant is used. After removing the yellow-dyed wool from dye bath, add to the bath 2 ounces of copper sulfate and stir until thoroughly dissolved. Enter another half-pound of washed and rinsed wool. Simmer until a clear pale green has been achieved, then rinse and dry.

White Birch **Light brown; green**
(*Betula papyrifera*)

Use the inner bark. A mordant is not needed.

For light brown:

1 pound bark
½ pound wool

Break bark and crush into small bits, put in muslin bag and soak overnight in soft water (rain water). In the morning boil for one hour. Enter washed and rinsed wool while still wet. Simmer for half an hour. Rinse thoroughly and dry.

For green: Use the same quantities as for light brown, but add 2 ounces of copper sulfate. Stir until dissolved, enter wetted wool and simmer for one hour. Rinse and dry.

Bedstraw **Brownish pink**
(*Galium boreale*)

Use the roots only.

½ pound bedstraw roots
1 ounce alum
½ pound wool

Crush roots, put into muslin bag and soak overnight in soft water. In the morning boil for one hour, add alum, stir until dissolved. Enter wool, simmer for half an hour or until desired color is reached. Rinse thoroughly and dry.

For a deeper shade:

¼ pound bedstraw roots
¼ pound wool
4 ounces white wine vinegar
4 quarts soft water

Soak bedstraw roots overnight. In the morning boil one hour. Add vinegar and wool which has been washed and rinsed. Boil gently one hour. Rinse thoroughly and dry away from sun. ◆

CANADA

From British Columbia

Katherine Wilson Tye

Horsetail **Greenish yellow**
(*Equisetum*)

Equisetum is a very useful dye plant because it not only produces a pleasing yellow color, but it also makes an excellent base for top-dyeing with another color.

In spring gather a generous basket of the bright green plant, discarding all roots. Put the plants into a granite pot filled with rain-water. Add about one-tenth the weight of mordanted wool (using standard alum mordanting method) in alternate layers with equisetum. Simmer for one-half hour, rinse well in warm water and dry in the shade.

Any of the dyed wool not used as yellow yarn should be kept to top-dye with various other plants of different colors, later in the season. The light yellowish color seems to brighten and improve other dye plants such as madder, lupine, birch leaves, tansy and many others. Top-dyeing with a small amount of indigo gives a lovely pale green.

Lungwort **Beige to deep orange brown**
(*Lobaria pulmonaria*)

This lichen is found mostly on Pacific maples in the damp forests of British Columbia, Canada. It can be picked off the ground after a storm at any season of the year. Otherwise, it is difficult to obtain as the trees are very high. It is green and limp when wet, but when dried it turns to a beige-brown. It can be hung in hemp sacks in a dry place and used at any time.

Equal weight of dried lichen gives wool a light brown color, but by increasing the quantity of lichen a deep orange-brown is obtained. No mordant is needed.

By using eight to ten times the weight of lichen to wool, one can obtain three blending colors from one dye bath. Slowly boil the lichen and wool until the orange-brown is reached; then remove the wool and enter another skein, boiling until a light brown is reached. Again remove the wool and enter a third skein; boil until a soft beige is reached.

Gottscho-Schleisner

The branching green stalks (*center*) of horsetail (*Equisetum*) impart a greenish-yellow color to alum-mordanted wool; especially good as a base dye for other colors. The reproductive stalks (*right* and *left*) are not used.

Yellow Lichen **Brilliant yellow**
(*Letharia vulpina*)

This brilliant yellow lichen of the mountains of the Pacific Northwest, found mostly on fir and pine trees above the 2,000-foot level, is one of the best lichens for dyeing wool as it gives the same brilliant yellow as itself. It can be gathered at any time of the year with equal success. It will dye a pleasing pale yellow if a little is used, and an increasingly deep yellow if a large quantity is used. It requires only a short boiling. When washed, rinsed, and dried in the shade, the wool has an almost luminous quality. It is the perfect lichen dye for the beginner. No mordant is required. ◆

IN THE UNITED STATES

Allen M. Parrott

Peach leaves — Yellow

For a "sour" yellow color, cover one bushel of peach leaves with ten gallons of water. Allow to stand in a warm place completely covered for a week or two.

Mordant one pound of light gray wool with potash alum. After boiling, drain, wrap in a cloth and let the wool stand several days. Rinse yarn, then cook one hour with the fermented peach leaves.

Green Walnuts — Brown

With green walnuts which have been smashed and boiled, it is possible to get a variety of browns.

Alum-mordanted yarns will become a rosy brown. Chrome-mordanted yarns will become a darker black-brown. Unmordanted yarns tend to become gray-brown. Adding a pinch of copperas after dyeing has taken place will give the brown a greenish cast.

Iron vessels should be used.

Calliopsis — Brick red

A brick-red color can be derived from the red-and-yellow flowers of calliopsis (*Coreopsis tinctoria*).

Mordant one-half pound of wool or yarn with potassium dichromate. Drain, rinse and then boil with one-half bushel of calliopsis flowers until a dark brick red is obtained.

Note: The paler colors obtainable from the calliopsis plant are fugitive. ✦

Sue Johnson

Green Lichen — Yellow to greenish yellow

The branched green lichen found on rocks in California gives a clear light yellow on wool when the directions below are followed. A larger quantity of the lichen (identified as *Evernia vulpina*) imparts a greenish tone.

Boil 5 ounces of green lichen for one hour in water to cover, adding water as necessary. Strain through cheesecloth and have sufficient liquid to cover five to six ounces of raw wool (scoured and carded). Moisten wool and place carefully in liquid. Boil for one-half hour without stirring. Add two tablespoons cream of tartar. Boil gently for another half hour. Squeeze and dry. Re-card wool; any variations in color will then be blended.

Onion skin — Golden tan

(*Allium cepa*)

A small quantity of onion skins will produce a golden tan. For each pound of scoured and carded wool use one ounce of skins from brown onions. Cover onion skins with water and boil for two hours, adding water as necessary. Strain through cheesecloth. Place dampened wool in liquid, being careful not to agitate. Bring to a boil and simmer, without stirring, for one-half hour. Add two tablespoons powdered alum and simmer half an hour longer. Let cool and rinse in cold water until water is clear. Squeeze and dry. Re-card wool to blend color variations. ✦

HISTORIC BUILDING, DYE-PLANT GARDEN

Forty species of dye plants and ten of textile fiber sources are grown outside the Old Slater Mill, now a museum, in Pawtucket, Rhode Island. Planted by the New England unit of the Herb Society of America, the garden is maintained by the Pawtucket Garden Club. The building was the first successful water-powered mill to spin cotton in America. Constructed in 1793, it was in operation until 1920. It now attracts many visitors (35,000 in 1963) with its permanent exhibit of the development of spinning.

UNITED STATES

FROM BOOKS OF AMERICAN DYERS

Elderberry Lilac blue; violet purple

(*Sambucus nigra*)

The berries and leaves of the elderberry contain dyestuff. The berries give a varying color depending on the amount used and the time of boiling; a long simmering deepens the color. The berries are difficult to use. To obtain an even color, wet the wool, enter quickly and stir continually. Careful mordanting is a prerequisite.

To one peck of fruit, bruised and boiled thirty minutes, add one tablespoon of salt. Strain out the fruit before dyeing.

The depth of color may be varied by the amount of fruit used as well as the boiling time. Alum mordant produces a lilac-blue and chrome a violet purple. The colors obtained are as good as those from logwood.

Two gallons of leaves shredded and bruised give shades of yellow with both alum and chrome mordants. An old recipe says "elderberries stewed with copperas, vinegar, and alum make an excellent ink."

From THE DYE-POT by Mary Frances Davidson. Published by Author, Shuttle-craft Shop, Middlesboro, Kentucky, 1950.

* * *

Rhododendron leaves Gray

(*Rhododendron maximum*)

Use only the leaves of rhododendron, and, if possible, soak them in water overnight.

In an iron kettle boil the leaves covered with water at least two hours. Strain and return the ooze to the same kettle adding enough water to make a generous dye bath. Now, add the copperas, and when it is thoroughly dissolved add the wool. Simmer for thirty minutes.

Remove the wool from the dye bath, rinse until the water is clear, and hang the wool in the sun to dry.

Roche

Fruits of the native elderberry (*Sambucus nigra*) will give lilac blue with an alum mordant, violet purple with chrome. The leaves alone give various tones of yellow, according to the mordant.

While the leaves boil, wash your wool in a good soapsuds, rinse and leave it to soak in water until ready to use.

As long as there is dye in the water, you can add successive skeins of wool and get a nice shade, each one lighter in tone.

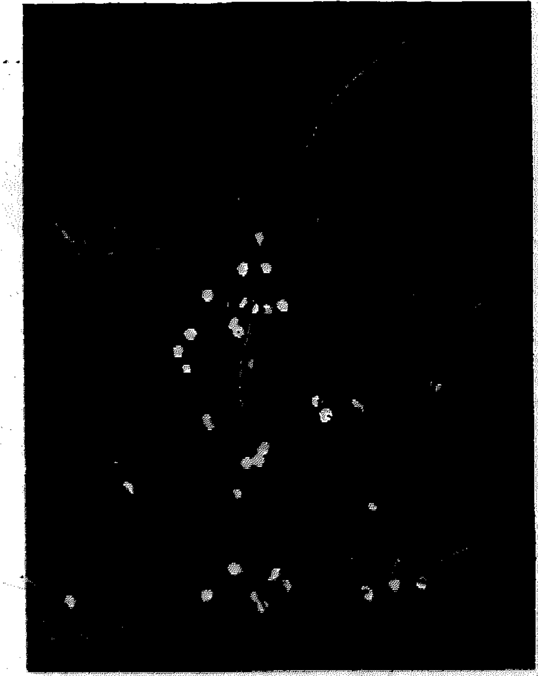
From VEGETABLE DYEING by Mrs. Emma Conley. Second edition revised by Mrs. Meta Lewis. Penland School of Handicrafts, Inc., Penland, North Carolina.

* * *

Juniper; Red-cedar Khaki

(*Juniperus*)

The bark, berries and twigs are all suitable for dyeing wool. Berries are commonly used and produce with this special



Buhle

The small blue "berries" which occasionally cover the branches of red-cedar trees (*Juniperus virginiana*) can be used to dye wool a khaki color.

Juniper (*continued*)

recipe, a good khaki color. For a pound of wool proceed as follows:

Dissolve the alum, ammonium chloride, cream of tartar, and copper sulfate in 4 to 4½ gallons of soft water. Put in the wool, wet thoroughly and squeeze out the water, boil for 1 hour, and let stand in this mordanting liquor until cold, then rinse. Break up the berries, tie in a cheesecloth bag, soak in water overnight, then boil for 1 hour and add enough cold water for the dye bath. Immerse the mordanted wool in this dye extract, boil for 1 to 2 hours, and remove. Add the copper acetate to the dye bath and when dissolved, return the yarn or cloth, and boil for 15 to 30 minutes longer. Rinse and dry.

From USING WAYSIDE PLANTS by Nelson Coon. Hearthside Press, Inc., New York, third revised edition, 1960.

RECIPE FROM THE BAHAMAS

Harriet S. Buchheister

Red Mangrove **Tan**

(*Rhizophora mangle*)

For silk or linen

1 pound bark from mature trees

3 quarts water

Boil the bark until the color seems right. Remove the bark from the dyebath and steep the cloth (without crowding it) until a shade darker than the desired color is achieved. Rinse several times in clear water, then add salt—a few spoonfuls—to the last rinse water. No mordant is used. The color is a rich, warm tan. ◆

Buh

Mangrove trees commonly grow out toward salt water from shorelines. The bark of many kinds can be used as a dye. Shown here is *Rhizophora mangle*, which produces a rich warm tan without a mordant.

FAMILY DYEING IN COLONIAL NEW ENGLAND

A bit of history

Martha Genung Stearns

TO the early explorers along America's eastern coast, this country seems to have had a colorful fascination, according to the records they have left us. Mariners from England passing by in the spring thought New England an earthly paradise, with flowers, herbs, vines, nut trees and other valuable plants.

In surveying this new land the early voyagers were quick to recognize trees and other plants which resembled those they had known at home. What they called "the diar's shumach" was noted. This was probably staghorn sumac (*Rhus typhina*) or smooth sumac (*R. glabra*), which could easily be mistaken for the European *Rhus coriaria,* known to them as good for dyeing and the tanning of leather. They also commented on the "divers roots and berries wherewith the Indians dye excellent holding colors that no rain or washing can alter."* Reading this, we wonder if the Indians used fixatives of some kind. But other early reports indicate that, while the Indians used the red juice from bloodroot to color their faces and paint imitation blood on their tomahawks, slimy green algae from stagnant water to make a green stain, and lichens scraped from stones for yellow, these colors did not stand up for fabrics.

Henry Josselyn, who came as a sightseer and later settled in Maine, speaks of "wood-wax (*Genista tinctoria*), wherewith they dye many pretty colours." There is a tradition, however, that this was introduced by Governor Endicott 40 years before Josselyn was doing his herb-hunting; it was easily naturalized but at the time was confined largely to the neighborhood of Salem, Massachusetts. (This plant is less correctly known as woad-waxen, and is also called dyer's greenweed because its yellow coloring gives green when combined with woad or indigo.)

Among the plants that looked familiar to North America's colonists from England were the red-fruited sumacs, like *Rhus typhina,* above, because of their resemblance to the European dyer's sumac (*Rhus coriaria*). American species of sumac became important as dye plants at an early date; also extensively used in tanning.

Seeds of Herbs for Dyeing

Anyone who has seen Mayflower II, the replica built as nearly as possible to the specifications of the original ship, must have realized what an almost superhuman job was done in packing away all the passengers with their household gear and supplies for the voyage across the Atlantic. Even in the small ships which followed during the first few years there was little space to spare. But we are told that the women brought little bags of seed with them, and it was surprisingly soon that they managed to make real homes and set up simple household arts. They planted herbs and cultivated native ones which they discovered. When they sent memorandums back to England for needed supplies, they included seed for growing woad (*Isatis tinctoria*). This blue was never as good as that from indigo, which could penetrate material with a brighter and more lasting color, but it was the native English dye plant with which they were familiar.

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*Quoted from "The Flora of Colonial Days" by Mary T. Saunders (Essex Institute Bulletin, Salem, Massachusetts, 1895).

We can well imagine that the early dyeing experiments with American plants were carried on by the trial and error method. In those days any housewife would know something of the subject, and the new continent gave the colonists many plants, barks, roots and berries which would impart good colors to their fabrics. When they found plants that were similar to those they had used before, they tried them out.

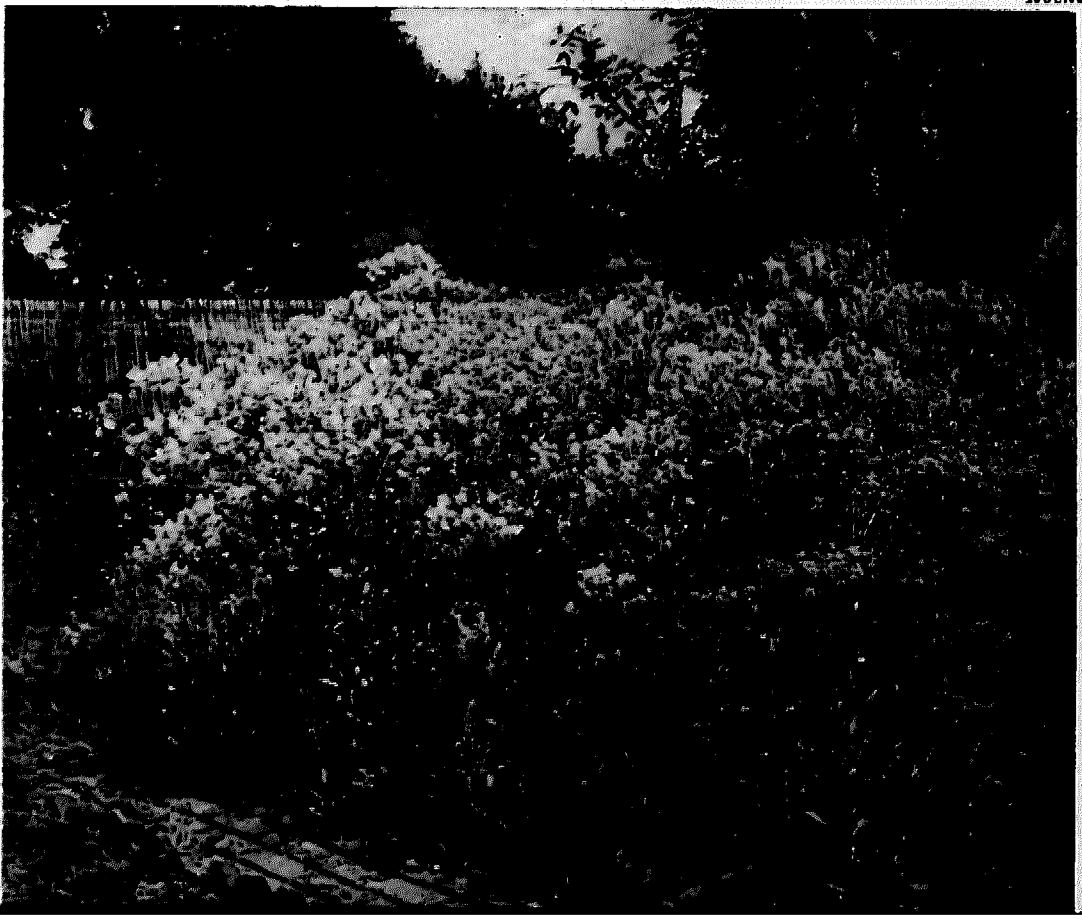
Home-made Mordants

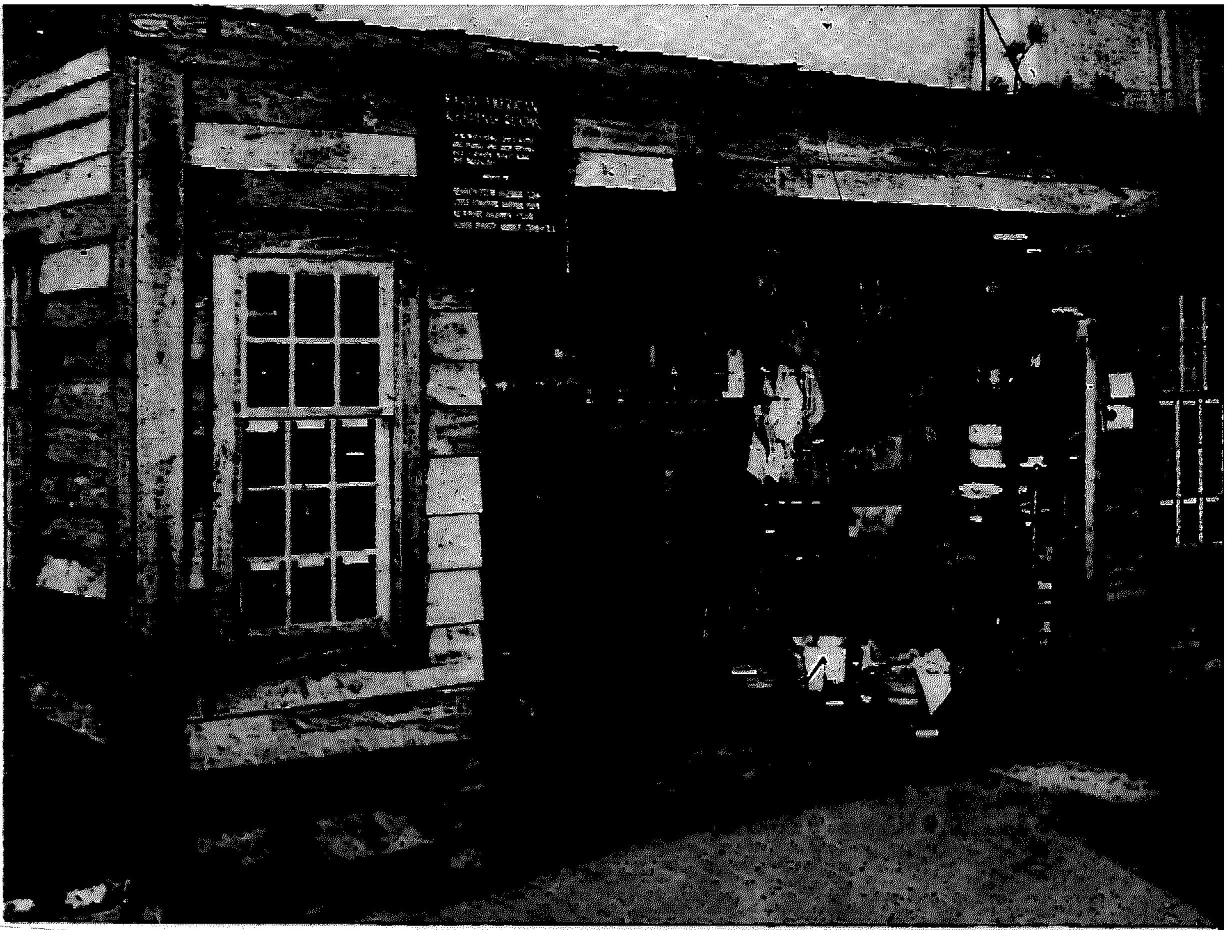
The method was to extract the juice by infusions, but these varied in strength; the juice of above-ground parts of a growing plant would not be as strong as that of the root. And it was not enough merely to dip and soak the fabric in these juices, as the color could easily be washed out again unless some good fixative was used to set the dye. We all know that a stain caused by iron rust on a fabric can be bleached out only with difficulty. So, though ill-equipped to deal with such problems, but with mother-wit coming to the rescue, they made a metallic mordant from rusty kettles and old nails, even filings from the blacksmith's forge. Many of the early dyes gave dull browns, yellows and grays, probably because of the underlying tint from the iron mordant. These dismal shades which were so predominant were described by such depressing names as drab, snuff, liver, sad-color.

It is no wonder that our foremothers

One of the supplies required from England by the 17th century colonists in New England was seed for growing the woad (*Isatis tinctoria*) with which they were familiar as a blue dye plant. Here it is shown in flower in a garden of today.

Roche





Hugelmeyer

EARLY AMERICAN KEEPING ROOM, DEMONSTRATING HOUSEHOLD USES OF PLANTS

Dye plants were important to the American colonists. For the exhibit illustrated here, more than 50 colors and color tones were produced from natural materials in accordance with colonial practices. This award-winning keeping room was displayed by the Garden Club of America at the New York Flower Show (1954) to carry out the organization's theme of the heritage of American gardens. It was prepared by four New England member clubs: Bennington, Little Compton, Newport and South County. Culinary and medicinal herbs were also shown. The dyed materials have since appeared in more than twenty exhibits. The "keeping room" was described at the time of the Flower Show as "literally the center of the house and of its activities. There, in the winter, in front of the broad hearth, the housewife cooked, churned, washed, ironed, dyed, pounded herbs, dried them over the mantel, made infusions, spun and wove, made candles and soap, and there the family ate and often slept."

wanted colors other than these. It was all very well to use drab for working clothes, aprons and half-sleeves to draw on over their clean cuffs, but their souls longed for red, bright blue and, somewhat strangely, purple.

As a mordant for some colors, chamber-lye (urine) was easily procurable, but the use of it was offensive.

Words Out of the Past

Here is an anonymous quotation lent to me by a very old lady: "Butternut bark made a beautiful brown; a certain moss made a tan brown. Alder bark made a seal brown. Birch bark a gunmetal gray. Yellow-root, barberry bark and sassafras made yellows. It always took two things to make green; indigo and goldenrod colored green, also laurel leaves and hickory bark. Black was one of the hardest colors to set; mercury or poison ivy made a pretty good black. Purple flag and elderberries gave lavender, but a fast lavender and purple was hard to get. To set the color in cloth, copperas, alum, salt and sometimes rusty nails were used. Every family had a dye-pot, most commonly used for indigo. After the spinning of the yarn or thread was finished, the housewife was busy getting the dye prepared. All the family knew that chamber lye should be saved for this. The indigo and yarn were put into the earthen pot full of chamber-lye and allowed to stand for a long time, after which it did not need to be 'set.' The odor was very offensive, and sometimes sweet-fern, flag-root or hardwood ashes were used to offset the odor."

Fine Colors Gradually Achieved

Eventually our ancestors came to be proud of the beautiful soft colors they wove into rugs, coverlets and other woolens. The plants for creating these colors were gathered in the woods and fields.

In a book entitled "Suite du Teinturier Parfait" (Paris, 1716) or "Instructions in the Art of Dyeing," there are about 35 recipes for reds to use on different fabrics: silk, wool, linen and cotton. About the only successful red dyestuff for linen and cotton was brazil, the coloring matter which came from brazilwood (*Caesalpinia echinata* and related species) of South America. The wood that became known for the red color it gave had already given its name to the country where it was found, not the other way around. This fact indicates the importance of dyes in early commerce.

Antiquarians and lovers of beautiful things of the past have long known that Venice was the source of the most beautiful fabrics. Perhaps red materials were the most noted; Venetian scarlet was famous all over the medieval world. It is interesting to read that many of the ingredients used for dyes are much the same as our own, but the process remained a secret, as did the Venetian method for black. These were two colors greatly desired by our American dyers. The Venetians also had purple from those famous Murex shellfish of the Mediterranean, another fast color still being sought in America almost until the aniline dyes were introduced.

How long was it to take our American amateurs to perfect their black, red and purple from nature's wild sources alone? The list of browns grew: olive, snuff, bat-wing, dove or lead, slate, cinnamon, dark copper brown, chocolate, and plain brown—and that is not all. Yellows were abundant, but red, purple, and black were difficult to achieve. For blue there was indigo or woad. Peddlers used to come twice a year on regular routes and housewives estimated how much indigo they would need for their amount of yarn.

Though woad was cultivated, it was always considered as secondary. "There was not much difference, chemically, between woad blue and indigo blue, and the woad which grew readily in northern countries was substituted for the Oriental indigo for domestic purposes. This was partly due to the fact that the ashes of woad, when the stems and waste were burned, were the best source of potash and lye; and as such, woad has been used down to the present day as an adjunct to dyeing with indigo in potash solution. . . . But woad was a disagreeable plant, exhausting the soil so that new tracts must constantly be given up to it, and also fermenting in the dyeing process and becoming extremely odorous." [From *The Herbarist*, of the Herb Society of America, Boston, Massachusetts, 1939.]

Native Sources of Ink

Ink was made from several native plants in colonial days. Among them were the pokeberry, inky-cap mushroom, sumac, and the bark of the red maple.

James Franklin, older brother of Benjamin, who was his apprentice in his Boston printing shop, printed *The New England Courant* in 1721, and also did printing of calico and other fabrics "in good figures, very lovely and durable colors, and without the offensive smell which attends the linen printed here," according to his own advertisement in the paper.

The early history of the dyeing industry in the United States is intimately connected with the small towns, according to Sidney M. Edelstein, in a paper published in the *American Dyestuff Reporter*. Almost none of the early American books on dyeing came from the large cities. The first one, appearing in 1798,

The Dyeing Corn

IN Elwin L. Page's book entitled "George Washington in New Hampshire" (Houghton Mifflin, 1932), the author quotes frequently from Washington's diary. There was very little that escaped the great man's eye. Here is a note in his own words: "And having walked through most parts of the Town (Portsmouth), returned by 12 o'clock, when I was visited by a clergyman by the name of Haven, who presented me with an Ear and part of the stalk of the dyeing Corn, and several pieces of cloth which had been dyed with it, equal to any colours I had ever seen, of various colors. This Corn was blood red, and the rind of the stalk deeply tinged of the same colour." The Portsmouth visit was in November 1789. [Brooklyn Botanic Garden tests failed to confirm corn as a dye material, but red corn husks dye wool dark gray.—ED.]

was "The Country Dyer's Assistant," by Asa Ellis, about whom little is known except that he was "a good dyer and a clear thinker." The next important book on dyeing, *A Practical Treatise on Dyeing and Callicoe Printing,* was published in Philadelphia in 1815. It was by Thomas Cooper, who was evidently a man of hasty temper, for he had to change his residence from time to time to avoid getting into embarrassing political situations. "There was always someone around upon whose feet he trod," writes Mr. Edelstein.

19th Century Dye Books

Also in 1815, "In Conformity with an Act of the Encouragement of Learning," a book in two parts was published giving "A General Plan of Dyeing, etc., Also Milling and Finishing, Stamping and Bleaching Cloths." The first part is by Evert Duyckinek, and it gives many useful recipes for dyeing, staining, painting, etc. It is put together in a rather confusing manner, however, the author discussing his recipes in a chatty, informal way. He recounts not only his triumphs but also his failures in producing reds, violets and purples. One recipe claims that 20 shades of violet color may be produced by varying the logwood and *braziletto* (brazilwood). "The further management of this dye, I have left to the fancy of the dyer, for the color will be beautiful, almost equal to cochineal and indigo. You may use peachwood in part, if you like, instead of all braziletto, but this I leave to your own choice." (Logwood, or peachwood, is *Haematoxylon campechianum,* a Central American tree related to *Caesalpinia.*)

The second part, by Elijah Bemiss, is more narrative. He loves his colors, such as "deep blue, bordering on the violet, brilliant, lively and shining," and he refers to his vat as "she," and treats "her" lovingly. One is entertained as well as instructed.

Meanwhile, in 1811, an anonymous little pamphlet had appeared, with recipes for "Dying, Hot and Cold," price "six pence, for Domestic Uses, in New England." Here is a typical recipe for yellow on cotton or linen (hot): Take two pounds of the leaves or peelings of onions that are clean and clear from dirt; put them in fair water, boil well, and you will have a good color." There are two recipes for plum color or purple (hot), for silks, and another for purple on cotton or linen (cold). Almost all of the 21 recipes begin with the words "Take your Butternut . . ." (or whatever it be), and end, "Handle till your color pleases." One may take this as a primer in the great library of dyeing.

The first book containing colored samples, by Cornelius Maloney, was published in 1833. By 1850 there was a dignified little volume from Philadelphia by Henry C. Baird, successor to E. L. Carey, with quite a repertory of colors, including innumerable browns and a great many reds, all in the cryptic language of the trade. The very first recipe is "To Make Light Purple for One Color on Jaconets," followed by several others evidently intended to assuage the feminine yearnings for purple. (Jaconet is a thin cotton material.) Somewhere I ran across a recipe for "a wash to bring back or strengthen faded purple."

Colors of Old Yarns Today

In the realm of old crewel yarns, one of the ways of approximating the age of a piece of old needlework is the condition of the purple. It has usually turned into a rather violet-tinted gray, probably starting out as a mixture whose components faded differently. In the past, many an attic's storage trunks contained the remains of home-dyed yarns, still usable and still of lovely colors. Between 1815 and 1825 or so, all sorts of reds in various intensities were being produced from madder, and these have stood up well as soft and lovely tones of rose. Perhaps only time was needed to perfect them. The same is true of colors in the old pieced bedquilts made of cuttings or samples manufactured before the fateful date of 1856 when someone discovered mauve, the first coal-tar color. This event completely changed the dyeing industry. Synthetic products replaced color after color, and finally, indigo. ✦

AN AMERICAN HERB GARDEN IN ENGLAND

Dye plants used by early American colonists are among the herbs being grown in this garden at the American Museum in Bath, England. The garden was a gift to the Museum from the Southampton (Long Island, New York) Garden Club and was dedicated in 1964. Some of the herbs came directly from the authentic 17th–18th century garden at the Halsey Homestead Museum at Southampton.

NOTES ON AZTEC DYE PLANTS

Indians of prehistoric Mexico skilled in use of natural colorings

Emily W. Emmart

FRAGMENTS of paint adhering to ancient ruins in Mexico, despite the weathering effects of centuries of sun and tropical rains, attest the lasting qualities of the paint pigments used by the Indians in pre-Conquest times. The brilliant colors of the surviving codices, the bright colored pottery, the fragments of woven material dyed with native pigments which are to be found in numerous museums, all tend credence to the accounts of the 16th century conquistadors and historians who commented enthusiastically on the extensive knowledge shown by the natives of the New World in the preparation and use of dyes. In a letter to the Emperor, Charles V, Cortez wrote: "They have colors for painting of as good quality as any in Spain, and of as pure shades as may be found anywhere." Bernal Diaz, who accompanied Cortez on his first visit to the arcaded market at Tlaltelolco, refers to the displays of decorated gourds and gaily painted jars of wood, examples of which may still be purchased in the Indian markets of today. Fray Bernardino de Sahagun, one of the twelve Franciscans who came to Mexico in 1524, described the colored pigments as black, yellow, green, tawny, violet, and flesh color. These, he noted, were composed of various colors and extracts of pigments from animal and plant sources. Fray Toribio de Motolinia, also one of the twelve Franciscans, mentions, in his historical account of the Indians of New Spain, several pigments of botanical origin which the natives used in dyeing cotton and woolen cloth.

Early Exports of Dyes

Following the Conquest in 1522, the crude materials of three native pigments became important commodities of export. Mention is made of them in letters, historical records, and ships' manifests. One of these dyes, of animal origin, was derived from the cochineal insect (*Coccus cacti*), which lived on the cactus *Nopalea cochinellifera*. The pigment from the bodies of the insects was part of the tribute paid to Montezuma by the neighboring subservient tribes.

Concurrently with cochineal, the blue dye, indigo, was shipped to Europe in large quantities. This dye, known to the Spaniards as "azul de añil" or simply "añil," was derived from *Indigofera suffruticosa*, which grew extensively in Mexico and South America. In the Valley of Mexico the plant was known as "xiuquilitl" by the Nahuatl-speaking peoples, who used the blue dye not only for dyeing cottons and woolens, but also as a cosmetic. The Mexican dye was very similar to that derived from the Old World species of *Indigofera anil.*

Logwood Still in Use

A third dye which was rapidly introduced into Europe during the 16th century was haematoxylin, a purple coloring derived from logwood. This dye was either reddish purple or blue, depending upon the degree of acidity or alkalinity of the preparation. The tree from which the dye was extracted was known to the Aztecs as "uitzquauitl" or "huitzcuahuitl," meaning "spiny tree." Two species of this tree, ***Haematoxylon brasiletto*** and ***H. campechianum*,** are still used commercially for the extraction of the dye. The earliest illustration of a species of this tree is to be found in the Badianus Manuscript (Plate 68), where it is entitled "huitzquauitl." Hernandez was the first to describe its staining properties and to relate the dye to the trees' known by their native names, "huitzquauitl" and "quamochitl" in the Valley of Mexico, and as "curaque" in Michoacán, and to associate the wood of these trees with that known as "brazil" by the Spaniards. He states that a decoction of the wood was at first yellow, then became red and purple when boiled with alum. There are today no commercial substitutes for this natural dye. Like cochineal and indigo, it has remained an important article of trade, and today is indispensable in the histological laboratory.

16th Century Documents

To investigate further the sources of the dyes indigenous to Mexico at the time of the Conquest one must turn to documents of the 16th century which were written before the Aztec names were forgotten or the native usage of the plants obscured. To the natives of Mexico most plants appeared to have medicinal value, and the dye properties were mentioned often in the directions for the preparation of medical remedies. With the exception of one chapter on medicinal plants in the Sahagun manuscripts, and the occasional mention of a few dye plants of commercial value in historical accounts, only two documents of the 16th century are of primary importance. The first of these is a small herbal entitled *Libellus de medicinalibus Indorum herbis,* which is better known today as the Badianus Manuscript. Until its publication in 1940, this beautiful little herbal had lain unnoticed in the Vatican Library, under the title *Codex Barberini, Latin 241.* The text, dealing with medical remedies known to the Aztecs, is illustrated with 184 aquarelles of plants and trees. The brilliance of the illustrations, even today, attests the excellent quality of the native dyes of Mexico. The manuscript, written in 1552, within 30 years of the Conquest, was the work of two Aztec Indians, one Juan Badianus, who illustrated and wrote the original text in Aztec, and the second, Martin de la Cruz, who translated the text into Latin. All the plant names are in Aztec, and it is the analysis of these names which occasionally gives the clue to the use of the plants as dye sources. This little herbal is unique not only because it was written by Aztec Indians, but also because it contains the first illustrations of the plants of Mexico and is the earliest medical text of the New World.

The second important text is the great herbal of Francisco Hernandez, titled *Medicarum Novae Hispaniae Thesaurus, seu Plantarum, Animalium, Mineralium Mexicanorum Historia.* Because of the news of the rich medical lore of the Mexicans which had been brought to Spain during the 16th century, Philip II selected his court physician, Dr. Francisco Hernandez, bestowed upon him the title of "Protomedico of the Indies," and in 1570 sent him to Mexico to prepare a natural history of New Spain. Hernandez spent seven years in Mexico, exploring and studying the medicinal plants in the Valley of Mexico, especially those cultivated in the famous gardens of Atzcapotzalco, Texcoco, and Huaxtepec. When he returned to Spain in 1577, parts of his manuscripts were left in Mexico. These were published in 1615 by Fray Francisco Ximenez. However, the major part of Hernandez's Thesaurus was published in 1651 by the Accademia dei Lincei. This great herbal lists some 1200 native plants by their Nahuatl names and describes their usage. The analysis of these native names often reveals facts relating to the habitat of the plant, the color of the flower or fruit, the dye produced, or the medical properties, but for the modern identification of the plants one must turn to the 19th and 20th century botanists.

Colors Used in Badianus Manuscript

Of these two 16th century herbals, only the Badianus Manuscript is illustrated in color. The pigments used are orange, yellow, ochre, green, blue, magenta, scarlet, lavender, and white and black. Several sources of black pigment were known to the Aztecs. One was derived from the pods of the "nacascolotl" (*Caesalpinia coriaria*). Black soot from the "ocotl" or pine was commonly used; it is reported that a black dye was also prepared from the gum of *Prosopis juliflora,* called "mizquitl" in the Badianus Manuscript. In this herbal two different plants are referred to by the Aztec name "tlayapaloni," meaning "abundant-black-paint-plant." One is a climbing grapelike vine with clusters of reddish berries. The other is a bromeliad-type plant with fruiting bodies on a single upright stalk. The cherry "capulxihuitl" (*Prunus capuli*) was probably another source of purplish-black pigment.

Besides the haematoxylin already mentioned, a purple dye was extracted both from the fruit of the mulberry and from *Jatropha curcas,* which was known to the Aztecs as "quauhayohuatli." And mention should be made, although it is not of plant origin, of the excellent purple dye obtained from the sea clam, *Purpura patula,* found on the southwest coast of Mexico.

Sources of Red

Reddish pigments were obtained in a wide range of colors, some of which may have been used as a mixture of several dyes. A red pigment was obtained from the poinsettia, *Euphorbia pulcherrima,* which was known to the Aztecs as "cuetlaxochitl." A pigment was also extracted from the red flowers of the wild dahlia. Safford reported that both red and yellow dyes were obtained from *Cosmos sulphurus.* Similarly, the aril of the seeds of *Bixa orellana* yielded either yellow or red pigment. This was known to the Aztecs as "achiotl" and today as annatto (under several different spellings).

Yellow pigment was obtained from a leafless parasitic plant called by the Aztecs "zacatlaxcalli," identified as *Cassytha filiformis,* and from the bark of *Erythrina americana.* Another species, *Erythrina coralloides,* yielded a colored extract which was used in an eye lotion. This may also have been a source of pigment.

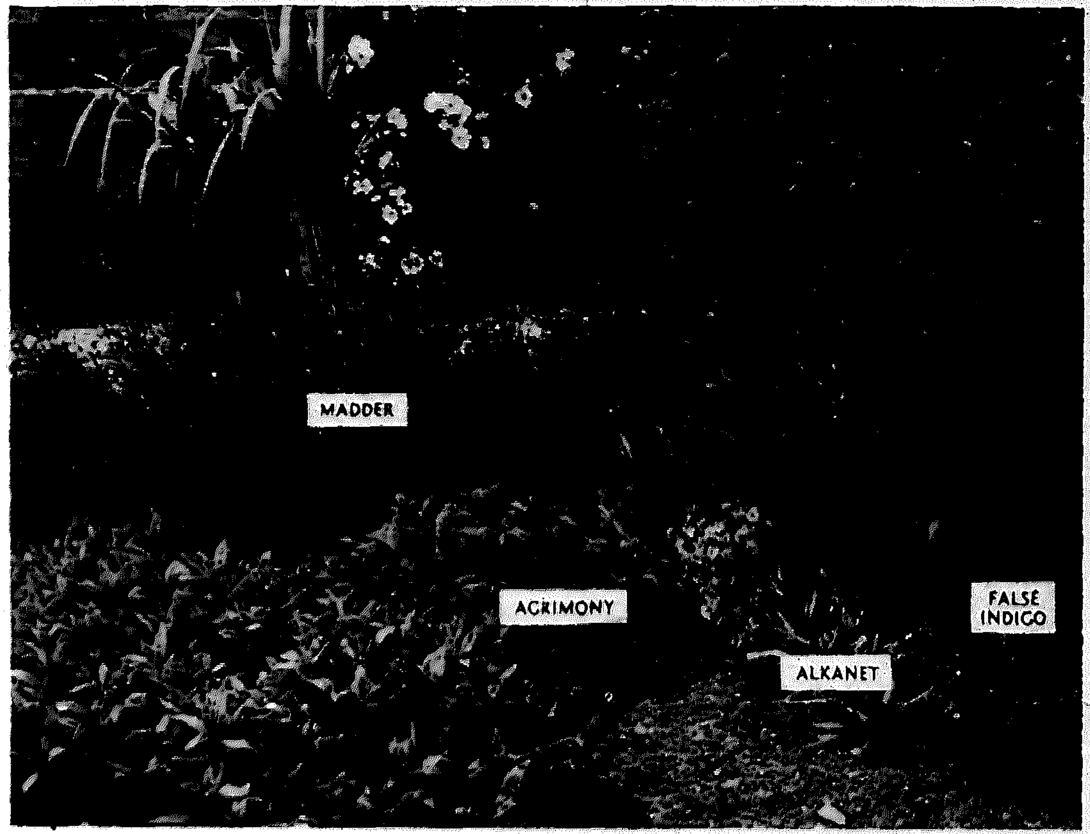
Besides the native indigo, bluish pigments were obtained from several plant sources. One, known as "mohuitl," came from two species of *Jacobinia, J. mohuilli* and *J. umbrosa,* and still another from the fruit of *Cissus sicyoides.* Various shades of brown were obtained from earth pigments as well as from the oak, and probably other unidentified sources. Green was most likely obtained by a mixture of indigo and yellow pigment.

To achieve light colors, white earth, "thicathalli," was mixed with the extracted pigment. Alum, "thalxocotl," was added to increase intensity and bind the color. The black fetid earth containing iron and sulphur deposits, which was collected as a scum near the shores of a salt lake and on the edge of hot springs, was used as a binding agent in preparing paints. Hernandez reported that in mixing pigments the Aztecs used an oil or wax called "axi" or "aje." This was obtained from the insect *Coccus axin,* which was bred for the purpose. The insects were boiled and the wax skimmed off the surface of the fluid and used both as a varnish and a pigment base. A crude turpentine was also prepared and used as a thinning agent. These few details tell us but little of the general practices of the Aztecs in securing the remarkably lasting qualities of their dyes.

Discoveries of the Future

Indeed our knowledge today of the dyes and dye plants of Mexico must represent but a fraction of that possessed by the Indians of four centuries ago. Moreover, the probability that many of the plants familiar to the Aztecs still exist in modern Mexico is a major challenge to the plant explorer. Analysis of the Aztec plant names in the great Thesaurus of Hernandez, and in the Badianus Manuscript, suggests that many of the plants treated in these herbals may have been the source of dyes unknown to us. Botanical identity has been established for only a few; the rest must await the future efforts of the ethnobotanist. ◆

DYE PLANTS GROWING IN A SCOTTISH GARDEN



Robertson

A corner of the private garden of William Robertson in Dundee, Scotland, where he aims to grow every textile and dye plant that will survive in this coastal region.

William Robertson

A NUMBER of years ago when I asked a prominent jute manufacturer if he could give me a photograph of *Corchorus capsularis*, he was unable to help. I remarked, probably acidly, that it seemed odd that three generations had prospered in the same mill and yet they did not have a photograph of the plant upon which their livelihood depended. His answer was put in the form of a question. "You're a linen man—do *you* have a picture of *flax*?" To my embarrassment I didn't. There and then I decided to create a collection of textile plants—those used for dyes as well as fibers—and take my own pictures.

At first sight the cold east coast of Scotland does not seem to offer much hope of success. Dundee is roughly in the same degree of latitude as the south tip of Kodiak Island in the Aleutians. Summers are cool, frequently overcast, with temperatures seldom above the 60's. Winters are not severe by continental standards, but there are long periods when the thermometer hovers at, or just below, freezing point. With insufficient snow cover this makes it difficult for some plants to survive. However, even if the sun appears erratically in the summer, it can still account for a respectable daily average due to the fact that in June and July it seldom gets really dark. Under these conditions Edinburgh, a mere 60 miles further south, still contrives to have one of the world's best botanic gardens.

My house is named "Tighnabruaich," which means "house on a bank." Facing north to the hills, it is well placed to see occasional displays of the northern lights. As witches, warlocks, and fairies are particularly prevalent in Scotland, in accordance with old Scottish practice, the house is carefully guarded by rowan trees (*Sorbus aucuparia*), which are supposed to afford complete protection. The local soil is extremely fertile and, given spring protection from wind and ground frost, plants grow with surprising speed. In my garden, soil conditions had, of course, to be specially provided for peat-loving plants, and one or two pockets were specially made from shingle, grit, and poor mountain soil, laboriously collected on safaris! Moisture-loving plants such as bog-myrtle or sweet gale (*Myrica gale*), have to be given their full ration of water, as there are no extremely wet areas in the garden. Contrary to popular imagination abroad, rainfall in east Scotland is no more than just enough for normal farming.

The areas I have devoted to textile plants are not particularly impressive. They have to compete with vegetables, fruit, roses, and "flowers for the vases." Mrs. Robertson is very firm about this, pointing out that the "botanics" are nearly always weedy and uninteresting, and in any case, she is not allowed to cut them! Also it should be noted that annuals (such as hemp and flax) and biennials disappear as soon as they have served their purpose, making room for something else. Lastly, dye plants such as strawberry-blite (*Chenopodium capitatum*) are noxious weeds, so they are grown under very careful control. Such plants, with their boxes and soil, are ruthlessly destroyed as soon as photographs of the flowers have been obtained.

The Scots have a long tradition in vegetable dyeing. Local dye-producing plants are, in fact, so abundant, that there is little point in growing them specially. Lichens, also abundant, supplement dyes from flowering plants and the varying brown shades of natural sheep wool. Plants permanently grown in my garden, therefore, tend to be difficult-to-

Robertson

Madder (*Rubia tinctorum*), the red dye plant of antiquity, thrives and blooms in the Robertson garden.

Cultural Requirements of Dye Plants

IN my experience in East Scotland, the following plants are not fussy about soil as long as it is good farm loam: madder, blackberry, safflower, weld, woad, nettle, soapwort, agrimony, anchusa, anthemis, asperula, baptisia, berberis, cornus, ligustrum, euonymus, polygonum, serratula.

Wet soil is needed for meadow-sweet. Woad demands precautions against cabbage troubles such as club-root and cabbage root fly. Euonymus is particularly a menace with black fly aphis and is poisonous. Weld seeds rather freely but is easily dealt with by hoe. Soapwort is the most aggressive plant I have (apart from meadow-sweet).

Peat is best under the given conditions for these plants:

Semi-shade—bloodroot
Full sun—heath, heather, kalmia, mahonia
Very wet—bog-asphodel, bog-myrtle

In gravel or stony ground I have lily-of-the-valley (gravel in semi-shade); gorse (stony soil in full sun); bedstraw and goldenrod (in river shingle). In sand on dry banks in full sun, genista, bedstraw, smoke-bush and St.-John's-wort are growing. In pure sand I have saffron. I have tried growing it indoors in bulb fiber, but it will not flower.

get specimens, though here and there local plants appear if they have interesting characteristics.

Dye plants form the largest group in my garden. Here are brief notes concerning the more important or interesting ones. Items starred (*) give reliable dyes. Names with a dagger (†) are of plants that were formerly of commercial importance.

Bloodroot (*Sanguinaria canadensis*)—red

American Indians used the juice of this plant both for a dye and as a war-paint. Peruvian Indians believed that it cured arthritis. A slave charm in colonial times, it was said to avert evil spells. Slow to establish itself in my garden, it is now thriving.

Bog-asphodel (***Narthecium ossifragum***)**—**
yellow

The shimmering blossoms of true asphodel suggested ghosts to the Greeks. This Scottish plant is a little gem, studding the wet moors with its yellow flowers. Used in the Shetland Islands as a substitute for saffron, and in Lancashire as a hair dye.

Bog-myrtle (*Myrica gale*)—yellow

A versatile plant, formerly indispensable to the Highlander. The leaves provided tea and medicine; their wax made aromatic candles. Long before hops, the plant was used to flavor beer. It was further used not only as a yellow dye but also as a flea-repellent in bed! Modern Scouts are still taught to bruise the fragrant leaves in their tents to discourage insects.

***†Dyers' Greenwood (*Genista tinctoria*)
—yellow; green when dyed over blue**

Worth a place in any rock garden. Formerly used as a greening weed to convert blue into Kendal green. The historical term "Plantagenet" is said to have been derived from the custom of Geoffrey, Count of Anjou, to wear a sprig of broom "planta genista"—in his cap.

Ladies' Bedstraw** (Galium vernum***)**—**
coral color

Also called "Our Lady's bedstraw" because, according to a medieval legend, the plant was used during the Nativity. As a reward, its white blossoms were changed to gold. Also used as a styptic agent, and (with nettle leaves) to curdle milk during cheese making. One would expect a relative of madder to provide good dyes and coral shades obtained from the roo are superb.

Meadow-sweet (***Filipendula ulmaria***)**—**
black (from roots)

This plant has taken over a damp nort

bank in the garden, where its fragrance is perhaps a little sickening. Once used to flavor mead and to cure malaria. The roots provide a black dye, which, however, does not compare with the beautiful black provided by the bark of common alder (*Alnus glutinosa*).

***†Madder** (*Rubia tinctorum*)—red

"Plays its part in half the hues of oriental rugs" (Mumford). The rather dull brick red from the roots has been used by physicians in studying bone growth. Middle-east dyers, by strange mixtures of rancid olive oil, cow-dung, ox-blood, potash, alum and galls, knew how to convert madder into fiery Turkey red. There is no space here to describe the cloak-and-dagger exploits of European spies wresting secrets from their Oriental rivals.

***†Venetian Sumac**—*Cotinus coggygria* (*Rhus cotinus*)—yellow

During late summer the spectacular inflorescence changes from salmon-pink to smoke-gray, thus accounting for names such as "burning-bush," "smoke-plant," and "wig plant." The yellow dye is obtained from the twigs or bark. The related *Rhus coriaria*, the dyers' sumac, has been described as the greatest gift of the Arabs to Sicily.

Blackberry (*Rubus fruticosus*)—orange (from roots)

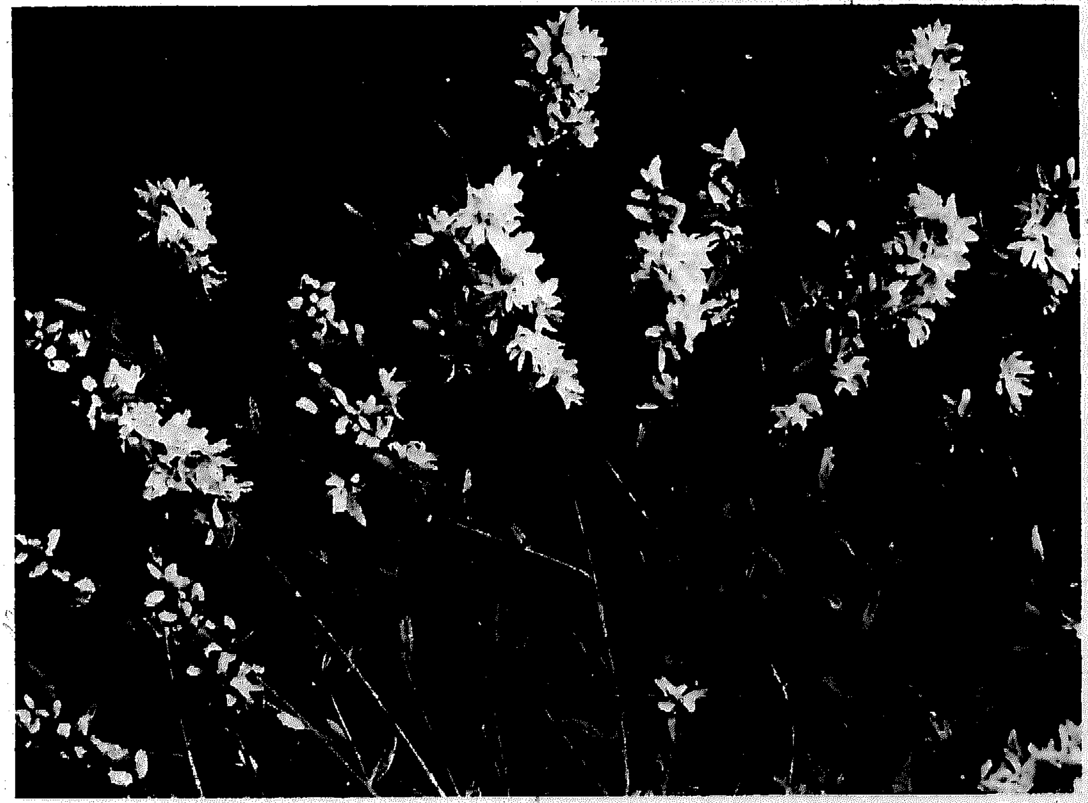
It is said in Scotland that Christ used this prickly plant to scourge money-lenders in the Temple, hence the Gaelic name "an druise beannaichte" the blessed bramble. In my garden the fruits are more highly valued than the orange dye contained in the roots.

***†Safflower** (*Carthamus tinctorius*)—yellow or red

Known to the Egyptians, and used in Indonesia long before turmeric became popular. First of all, the worthless yellow dye contained in the petals must be removed by washing. The red dye that results is valued but is difficult to apply.

***†Saffron** (*Crocus sativus*)—yellow

Used in the religious festivals of



Robertson

Dyer's greenweed (*Genista tinctoria*), a small shrubby plant, gives a yellow dye which has frequently been used to convert blue into green.

Robertson

The yellow-flowered ladies' bedstraw (*Gallium verum*), also called "Our Lady's bedstraw," grows on roadsides in Britain and on the continent, and is also sometimes seen in the United States; it has thickened roots from which a fine coral-color can be derived.

Minoan Crete, as a valued spice in Imperial Rome, and as an international commodity which gave its name to the Basle Saffron Guild because of its value as a yellow dye. In my opinion, the most beautiful of all crocus blossoms, but a shy bloomer in Scotland, where it thrives best in pure river sand under cloches.

***†Weld (*Reseda luteola*)—yellow or yellow-green**

The leaves, flowers, and stalk all provide a pure lemon yellow. A striking weed with attractively crimped leaves, it grows well in Scotland and seeds freely. It has appeared in Swiss neolithic settlements. With a ferrous sulphate mordant the dye produces handsome greengage-olive shades.

*†Woad (*Isatis tinctoria*)—blue

The long bitter struggle between woad growers and importers of tropical indigo is a fascinating story. Indigo (from both plants) is the only really good vegetable blue. Logwood does provide a useful blue but the tree is more valued for its lustrous black. Blues from berries such as the bilberry (*Vaccinium myrtillus*) are purplish and useless for commerce. In Scotland, the woad plant grows vigorously and flowers freely but its uninteresting cruciferous flowers would not enhance the appearance of the flower border.

Among other dye plants in my garden are agrimony (*Agrimonia eupatoria*), alkanet (*Alkanna* or *Anchusa tinctoria*), chamomile (***Anthemis tinctoria***), woodruff (*Asperula tinctoria*), false indigo (*Baptisia tinctoria*), barberry (***Berberis***

Robertson

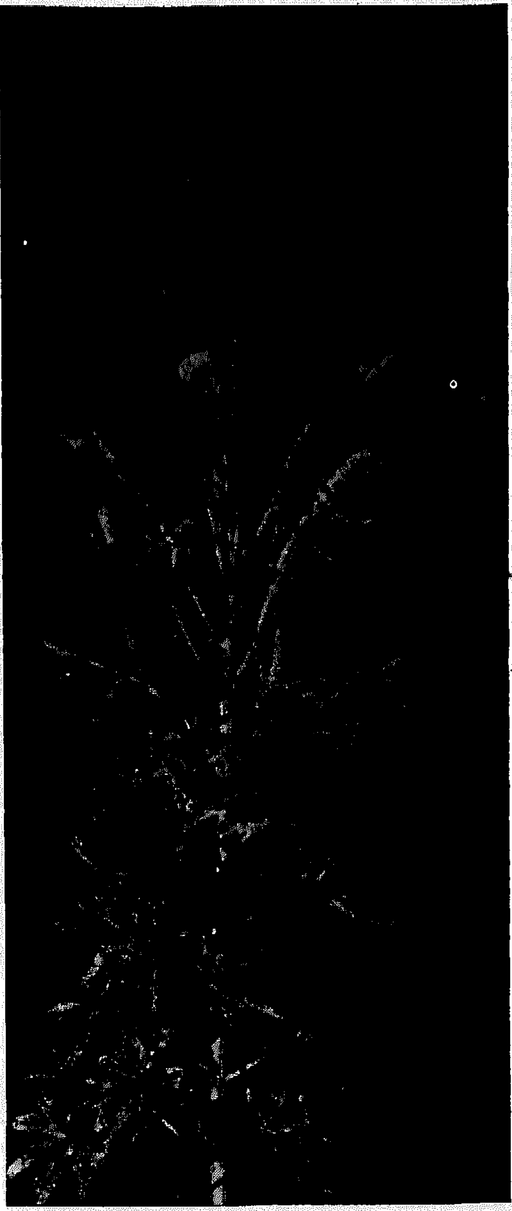
Alkanet (*Alkanna* or *Anchusa tinctoria*), an old-time dye plant with purplish flowers. Its root makes a reddish-brown dye.

vulgaris), dogwood (*Cornus sericea*), spindle-tree (*Euonymus europaeus*), St.-John's-wort (*Hypericum perforatum*), mountain-laurel (*Kalmia latifolia*), privet (*Ligustrum vulgare*), Oregon-grape (*Mahonia aquifolium*), knotweed (*Polygonum persicaria*), and serratula (*S. tinctoria*).

The above list comes far from exhausting the contents of my garden. Dye-producing plants such as lily-of-the-valley, walnuts (green husks), broom, gorse, heathers, heath, black currants, and many others can be used. Also without really trying, most gardeners can produce dandelion (magenta from roots) and dock (black from roots). If some readers are puzzled by different colors attributed to plants, it must be realized that the colors obtained depend on the mordant used and the dyeing techniques.

The kermes oak (*Quercus coccifera*) is of interest to dyers because it is the host plant of the kermes insect which formerly provided the world's best scarlet dye. The memory of kermes is preserved in European languages in Karmin (German word for carmine), cramoisi (French) and in our own word "crimson." Only half-hardy in Scotland, the tree needs protection, and in this rigorous climate the kermes insect does not infest it.

The Egyptians and Jews used the leaves of soapwort (*Saponaria officinalis*) to provide a preparatory process before dyeing. The lather produced is thin, however, and not very satisfactory. The plant itself, although quite beautiful, has a root system which is too aggressive for the average garden.



Robertson

Weld (*Reseda luteola*), also called dyer's mignonette, gives a fine, long-lasting yellow; with ferrous sulfate mordant, unusual green tones are obtainable.

The collection described above has obvious limitations, but it is only fair to state that it is often difficult for an ordinary citizen to acquire unusual specimens. One need not elaborate the problems of surmounting customs formalities and getting replies to correspondence! However, I have had the good fortune to visit many parts of the world, and as a relief from the tensions of business, have visited most of the famous gardens in the U.S.A., Mexico, the Caribbean, Europe (including Sicily) and of course, well-known British ones. I am pleased to report that on the whole, American authorities have been very helpful indeed, and that it was possible to track down and photograph many missing specimens in the collections there. It gives me particular pleasure to state that the tropical houses provided by The New York Botanical Garden in The Bronx and the Brooklyn Botanic Garden have been of great assistance.

PLYMOUTH COLONY'S DYE PLANTS

Garden at Harlow Old Fort House shows what early settlers used for coloring textiles

Rose T. Briggs

DURING the first years of Plymouth Colony, the Pilgrim settlers used what clothes and textiles they brought with them, having neither time nor materials to make new cloth. When the ship *Anne* came in to Plymouth in 1623, Governor Bradford ruefully records that the patched and mended clothes of his pioneer colonists had endured as much as their bodies. But what of it? To quote one contemporary jingle: "Double patches are warmer than single whole clothing!"

Though Plymouth's Patent of 1621, now in Pilgrim Hall, Museum of Pilgrim Treasures, lists the raising of flax and hemp as one of the industries proposed for the new colony, spinning wheels and other household textile implements do not begin to appear in the inventories until the 1640's. One can assume that the household implements that appear in a man's inventory have been in use for some time. Certainly in 1639, every household was required to plant at least one square rod of flax or hemp for its own use, and sheep were not to be sold out of the colony. Obviously, cloth was being made; but there is nothing to indicate that it was done on a professional basis. It would appear that each housewife supplied the ordinary needs of her household. Finer materials were imported. After the arrival of Winthrop's colony in 1630, ships came to Boston every year, bringing goods for which Plymouth settlers could exchange the cattle and farm produce the new colonists needed. Bradford's inventory (1657) lists cloth in wholesale quantities. Bradford was one of the "undertakers" who assumed responsibility for Plymouth Colony's debt to the London merchants who had furnished money for the original expenses. This cloth was no doubt to be sold or traded to raise money to pay off the debt.

What resources had the Plymouth housewife for dyeing her homespun yarn and cloth? Madder for red and indigo for blue had to be imported; the "West India" trade, which brought such items as "cotton wool" into 17th century inventories, must have made some Caribbean dye-stuffs available, if one had money to buy them. How about native dye-stuffs?

At the Harlow Old Fort House in Plymouth, the Plymouth Antiquarian Society has experimented with the dyeing possibilities of native material. This work is part of its program for exploring and demonstrating the way the Plymouth Colony housewife met the needs of her family. At Plimoth Plantation (a restoration of the Plymouth settlement as it probably appeared about 1627), there is also experimenting with native dyestuffs.

The problem in dyeing is to impregnate the fiber to be dyed with the coloring matter, and so fix it that it will remain when the superfluous dye is rinsed out. This means that there must be real chemical and physical affinity between the fiber and the dye-stuff; and this depends upon the chemical and physical qualities of both. Wool, silk, cotton, and linen all react differently to dye-stuffs. Some dyes suitable for wool will not dye cotton at all. Since the preparation of wool is a speciality of the Harlow Old Fort House, our experiments have been carried out with wool.

Most vegetable dyes require a mordant of some sort, to fuse with the dye-stuff and fix the color upon the fiber to be dyed. Many early mordants were household staples such as salt, vinegar, soda, cream of tartar, or lye. Both "drip lye" made at home from wood ashes (and also used for making soap and bleaching) and "chamber lye" (urine) were used. Alum, although it had to be bought, was per-

Dyeing homespun yarn in 17th century colonial fashion, as demonstrated at Harlow Old Fort House, Plymouth, Massachusetts.

haps the most useful mordant of all, especially for bright colors. Copperas (ferrous sulfate), which was invaluable for dark colors, also had to be purchased. When used as a final bath after the dyestuff had been applied, the process was called "saddening," and the result a "sad color." Blue vitriol (copper sulfate) was also used as a mordant. I do not know how early chrome (potassium dichromate) came into use as a mordant, but it gives excellent colors, more orange in tone than those obtained with alum. Some common metals, such as iron, brass and tin, act as mordants, and results can be obtained by using a vessel of the proper material. Thus a brass kettle was preferred for bright colors, an iron kettle for dark ones. Sumac and oak were useful as mordants as well as for coloring.

Chips, bark, roots, the hulls of nuts, leaves and flowers were all used as dyes. Some had to be used fresh. Some differed in the color developed according to the season in which they were gathered. Berry juices, although they appeared promising, produced stains rather than dyes, and faded or changed color quickly on cloth. The Harlow Old Fort House has found no lasting red nor satisfactory blue among the native materials it has tried. Even pokeberry (*Phytolacca americana*), with its magenta juice, fades to an unremarkable brown when applied to woolen yarn, though it can be used as a reddish stain for basket materials. Nor have the red fruit-heads of staghorn sumac (*Rhus typhina*) proved more satisfactory. The only color they develop which can be fixed on wool is a tan, which the addition of chrome turns to a yellow brown, and copperas turns to gray or black. The native dye-stuffs produce a wide range of yellows and browns, some grays and approximate blacks, and some greenish grays or grayish greens; but madder for red and indigo or logwood for blue had to be imported. Green was usually made by top-dyeing yarn already dyed with indigo, using yellow from some native dye-stuff.

Here are the plants now being used at Harlow Old Fort House, (many of them also being grown there) as representatives of the dye plants of the early settlers. Except for *Genista*, which now grows in Plymouth as an escape, and the household onion, all could be found in the wild.

Alder (*Alnus vulgaris*). The bark, with alum, dyes brownish yellow; with copperas, gray brown. The leaves, with alum, dye greenish yellow.

Apple (*Malus sylvestris*). The bark with alum gives yellow tan. Cultivated apple can also be used.

Bayberry (*Myrica pensylvanica*). The leaves can be used green or dry; with alum mordant they give yellow; with copperas (ferrous sulfate) added, olive gray.

Beach Plum (*Prunus maritima*). The leaves, with alum, give yellow.

Black Oak (*Quercus velutina*). The bark dyes yellow; with copperas added, olive green.

Black Walnut (*Juglans nigra*). Both the hulls and bark of the walnut provide one of the standard brown dyes. It can be used with or without additional mordants. Edward Winslow mentions the tree as found in Plymouth.

Bracken (*Pteridium aquilinum*). Used with alum and copperas, gives olive.

Dyer's greenweed or wood-waxen (*Genistā tinctoria*). This was introduced at Salem very early for dyeing yellow.

Goldenrod (*Solidago*). All species tried give a good yellow with alum. They are at their best used fresh.

Hemlock (*Tsuga canadensis*). The mature bark, with alum or alone, gives a warm brown.

Lichen. Lichens are often mentioned as a valuable source of dye. We have had good success with a gray, lacy lichen, growing in circles on oak and pine trees, which I have been unable to identify by name. It is associated with a similar lichen, with slightly larger and greener fronds, which is less satisfactory. The color produced varies from tan to orange brown. No mordant is needed.

Onion (*Allium cepa*). Skin used with alum mordant. Yellow is obtained by steeping, brown by boiling.

Red Maple (*Acer rubrum*). The bark, used with alum, gives olive; with copperas, gray.

St.-John's-wort (*Hypericum perforatum*). Alum mordant. If picked in July, this gives gray; in August, greenish yellow.

Sassafras (*Sassafras albidum*). The flower gives yellow with alum; the root, used with plum bark, brown.

Sheep-laurel (*Kalmia angustifolia*). With alum and copperas, dyes olive green.

Sumac (*Rhus typhina* or *R. glabra*). Both give tan with alum, gray to black with copperas.

Tupelo (*Nyssa sylvatica*). Gives yellow tan with alum.

White Oak (*Quercus alba*). With chestnut bark produces dove color; colors basket splints blue gray.

Willow (*Salix nigra*). Gives rose tan with alum. ◆

HOW ONE DYER STARTED

Needs of mountain children stimulated teacher to learn new craft

HELEN VINER of Tryon, North Carolina, went into the Kentucky mountains after her graduation from Vassar College to teach at a settlement school for boys and girls, just being started in Harlan County. But she did much more than teach the mountain children, and eventually, out of part of her experience there, she and her husband wrote "The Katherine Pettit Book of Vegetable Dyes." Here is the story of how she became involved in dyeing, as revealed in her autobiographical manuscript, "Pleasant Memories of Pine Mountain."

Helen Wilmer Stone Viner

SOME of my children at the settlement school in Kentucky came from broken homes, some were orphans and all were poor. I could get dresses for the girls and suits for the boys from the wonderful missionary boxes the school received, but warm sweaters, stockings, mittens and caps were hard to find. I was in despair to get my children warmly clothed.

I was telling my troubles to an old friend from down the creek, Aunt Leah Smith, and she advised me to swap old clothes for raw wool. Many neighbors had a few sheep. Once a week I "kept store" for the school and sold to the people the clothes that were not suitable for use at the school. So I followed her advice and swapped for the raw wool. Aunt Leah showed me how to wash and pick the wool. After that I swapped old clothes to have the wool spun into a single strand of yarn thread. It was brought back to me in corn shuck "broaches."

We had a spinning wheel at the house, and I doubled and twisted the two single strands together and had some very fine handspun knitting yarn. It was after World War I and every one had been in the habit of knitting, so I sent the yarn off, and my friends in various places knitted it up into sweaters, stockings, caps and mittens.

Still my problem was not solved, for all these garments were made of white wool, and with active children playing out-of-doors, making mud pies, bringing in coal, it was impossible to keep their things looking clean.

Dyes From the Woods

So again Aunt Leah came to my rescue, and told me I could get all the pretty colors I wanted out in the woods. Thus began my first interest in vegetable dyes. We went out in the woods and gathered walnut hulls, sumac berries, hickory bark, black oak bark, sedge grass, hard maple bark, the horse-sugar leaves, the dye-flower and many others. I sent off and bought madder root and indigo. I learned to dye with all of them. So the children wore sweaters made of handspun, vegetable-dyed yarn of every color of the rainbow, beautiful indigo blue, madder reds and rose, dye-flower orange, all shades of yellows, browns, grays, lavender and purple. It was just plain necessity that brought about my great interest in vegetable dyes.

Afterwards it was most interesting to find that the old recipes for dyes, handed down by word of mouth in the remote mountain communities, corresponded almost identically with those written down in books two hundred years before. ◆

How a group of handweavers set up

A WORKSHOP IN DYEING

WHEN a group of handweavers in Niles, Michigan, undertook a project in dyeing their yarn with natural products, many weeks of individual study and open discussion in meetings preceded the five-day workshop at which yarns for future display and reference were dyed. Mordants and yarn and other needs were purchased in advance. Eighty recipes were written out on 5 × 7-inch cards, each one numbered. When not in use these were kept in envelopes by color—yellow-gold-brass, brown-black-gray, indigo, and so forth. Recipes in use were clipped to a line or taped to the wall near each dyepot.

Early September was selected for the workshop, because many dye plants available locally would be in good condition at that time. All the required equipment was set up in a garage with individual electric burners for each dye pot. (Although recipes are normally proportioned for one pound of wool, a specified proportion was used for each dye batch in this project.)

The procedure, drawn from *Handweaver and Craftsman* magazine, Winter, 1963, is described here by one of the two co-chairmen of the project.

Kay Boydston

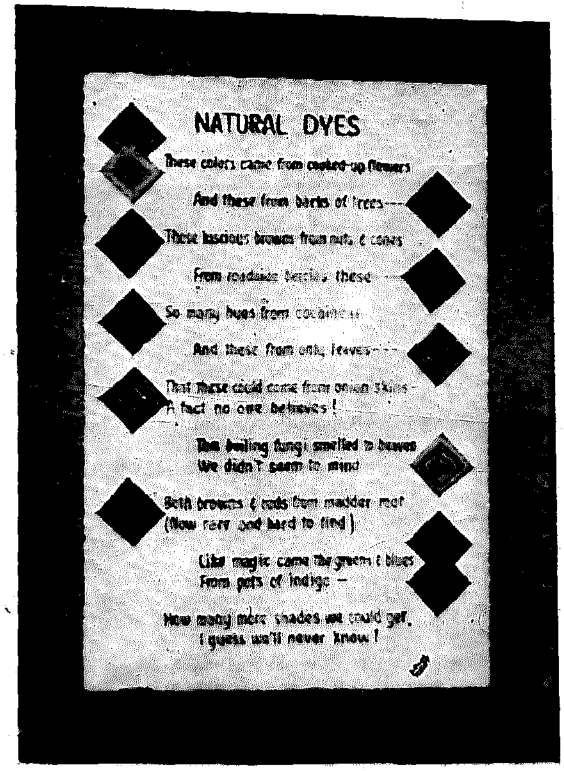
ON a central table in the garage where our project was set up were boxes of yarn containing small and large skeins for sample and display, each tied firmly but loosely in several places with strong but soft cotton twine. (Unless this is done, the yarn becomes a hopeless tangle.) The chemicals and scale and thermometer were here, also a pile of dress hangers, dozens of clip clothespins and many cardboard tags with string attached. Our list of 80 recipes, by number, was tacked to the wall, and the envelopes containing all the recipes were at hand for ready use. Each weaver had a similar envelope for her own notes.

On the first day several pounds of yarn in small skeins were mordanted in alum and in chrome. Dye plants for the next day's use were assigned.

The next morning we came with curiosity and some uncertainty. We came, too, with armloads of goldenrod and Queen Anne's lace, with baskets of marigold flower heads, with bags of bark and with pails of nuts and berries.

The group had been divided into teams of two or three. Each team had chosen recipes which called for dye material of special interest or easy availability, and that team was responsible for that dye from the time of collecting through the soaking, dyeing, rinsing and until the yarn was out of the ooze and hung up to dry. Sometimes a team could keep two or three recipes in progress. Each team attended to its own, but of course there was much peeking into other likely or unlikely-looking pots of color and a general gathering-round whenever it was time to lift out the wool.

Some yarns were rinsed right away. Some were dried before rinsing. Some dyes, marigolds for instance, were quick and easy. Some, as walnuts and bark, stretched over 24 hours or more. When drying time came, the small sample skeins were clipped to hangers, the larger skeins looped over them, and *each one as it came from the dye bath* was marked with a temporary tag, giving just the number of the recipe. The first ones to go on our line had many shades of yellow from marigolds—some clear and clean, some


NATURAL DYES
These colors came from cooked-up flowers
And these from barks of trees---
These luscious browns from nuts & cones
From roadside berries these---
So many hues from cochineal
And these from only leaves---
That these could come from onion skins -
A fact no one believes!
The boiling fungi smelled to heaven
We didn't seem to mind
Both browns & reds from madder root
(Now rare and hard to find)
Like magic came the greens & blues
From pots of indigo -
How many more shades we could get,
I guess we'll never know!

This wall hanging was made to demonstrate the dyer's craft in a group project staged by the Handweavers' Guild of Niles, Michigan. The colors shown are, *left, top to bottom:* yellow tones from marigolds; pastel tints from various wild flowers; tans and browns from nuts and cones; pink, rose, red and purple from cochineal; orange, rust and yellow tones from onion skins; coral, reddish brown and brownish reds from madder. *Right, top to bottom:* grays, tans and browns from various barks; grays from sumac berries, lavender from elderberries, red from pokeberries; caramel-color, golds and tans from various leaves; soft tones of beige from fungi; many blues and greens from indigo.

soft and "sad." As the days passed, hangers of other colors were added—the reds of pokeberry and madder, lovely browns from walnuts, grays from sumac, pinks, purples and reds from cochineal and finally, on the last day, the many blues and greens from indigo. Our rainbow was complete.

At the end of our exciting week, all yarns were packed away with their temporary tags until after the busy holiday season. They seemed even more beautiful when in January they were brought out again, the cotton ties cut off and a better permanent tag attached to each skein—this time a round metal-edged tag with the dye plant used written on one side and our recipe number, time required and mordanting information on the other. At this time a check was made to see that there was a small sample skein for every color and every dye. If not, one was taken from the large skeins. At the same time, a little more of each was wound off, marked as to dye plant, and put into bags labeled "barks." "leaves," "onions," "berries," etc. There were twelve categories. Several sets of cards wound with yarns were also made, all the colors from one dye material on one card, for easy reference. The small skeins, 129 of them, will never be used, but kept as reference material for the group. The large skeins have been arranged on a spool rack and exhibited in a shop, where they never fail to elicit interest. The yarns have also been shown at conferences of handweavers.

We were quite amazed that we could get around the color wheel with our natural dyes; all primary and secondary colors are true, and the shades between are good.

Bits from the larger skeins are used by our members for any technique or design requiring only small amounts of color. These, of course, belong to the individual weavers, but are to be made available for later displays if needed.

To show the blending of any or all of our colors, we have also made two mounted wall hangings of cream-colored burlap, one from the category bags; the other, just various color blendings of particular appeal. But our color wheel is our best effort to date.

With this project we had a taste to whet our appetites and we hope some day to pursue it further with plants not yet recorded or with the plants we used gathered at different times of the year, or used with different mordants. The whole field of over-dyeing beckons—the art of dyeing first in one color, then in a second. Our various yellows put with indigo to give many shades of green show the infinite possibilities here. ◆

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CAROLYN LOCK

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